AUTOMOTIVE and Aviation INDUSTRIES

NOVEMBER 1, 1943

How cutting oils and coolants can help

SUBSTITUTE METALS for scarce alloy tools may help provide enough tools to "go around" in war-busy plants. There is no substitute for tool care to make these tools last long enough to finish the job.

WPB's nine rules for tool care are all important. Point six, particularly—"Keep Tools Lubricated and Cooled—nothing will damage tools more quickly than operation without proper lubrication and cooling."

It is not enough to select cutting fluids that merely prevent tools from burning or tearing the work. The right coolant and proper application can add hours between tool changes, save excessive grinding and loss of tool stock, and give better finish and accuracy. These simple suggestions may help you give your tools a longer and more productive life.

1. Select the right cutting fluid. There is no simple formula for selecting the best cutting fluid for a particular job. The requirements for each job must be carefully analyzed as to the type of tool used—metals to be machined—cutting feeds and speeds—finish and accuracy required. With all of these facts, and a complete knowledge of cutting oil qualities, the cutting fluid requirements on any job can be determined without a great deal of trial and error.

You can eliminate the errors and many trials by discussing your problems with one of our Cutting Oil Specialists. His experience in other plants with similar problems will save making many experiments. His knowledge of products recently developed for these new problems will be invaluable.

2. Apply it in the right places. What cutting fluid you use is no more important than where and how it is applied. Flooding the tool and work is important for cooling action. There must also be a sufficient volume of fluid to reach the point of contact of tool and work. Operators should be cautioned to return the coolant stream to the most effective position after changing tools or work.

3. Keep it clean. Cutting fluids are subjected to considerable contamination. Metal particles should be removed at regular intervals by cleaning out the machine, or by filtering or centrifuging the oil. Coolant lines should be kept free from deposits by using soluble oils which form stable emulsions. Oils are available which do not become rancid or develop strong objectionable odors. Make this an important consideration in selecting cutting oils.

A Standard Cutting Oil Specialist will have many more suggestions for helping you conserve tools through the use of better cutting oils and coolants. Call any Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago 5, Illinois, for this service. In Nebraska, call any Standard Oil Company of Nebraska office.

WPB's Nine rules of tool care

1. Put your tools away. Tools are weapons; they must be kept sharp.

2. Change bits *before* they get too dull. You can work faster, better with a sharp tool.

3. Keep rocker rest flat with shims. Your tool point takes a better bite when the tool rest is flat.

4. Put blocks close—clamp work tight. If blocks are too far apart, work is springy, may snap drill. If clamps are loose, work may turn and hurt you.

5. Look out for point of drill. Adjust tool stop so point won't be damaged by the harder backing plate. Don't let drill point hit table when removing.

6. Keep tools lubricated and cooled. Nothing will damage tools more quickly than operation without proper lubrication and cooling.

7. Fit cutter snugly and evenly on arbor. If you force or pound the cutter on, it won't run true.

8. Keep yokes close to cutter. Otherwise you will get chatter and runout.

9. Keep spacing collars clean and parallel. Drunk milling cutters wobble, causing runout.

Oil is Ammunition... Use it Wisely

Standard Oil
CUTTING OILS
and
COOLANTS

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

AUTOMOTIVE and Aviation INDUSTRIES

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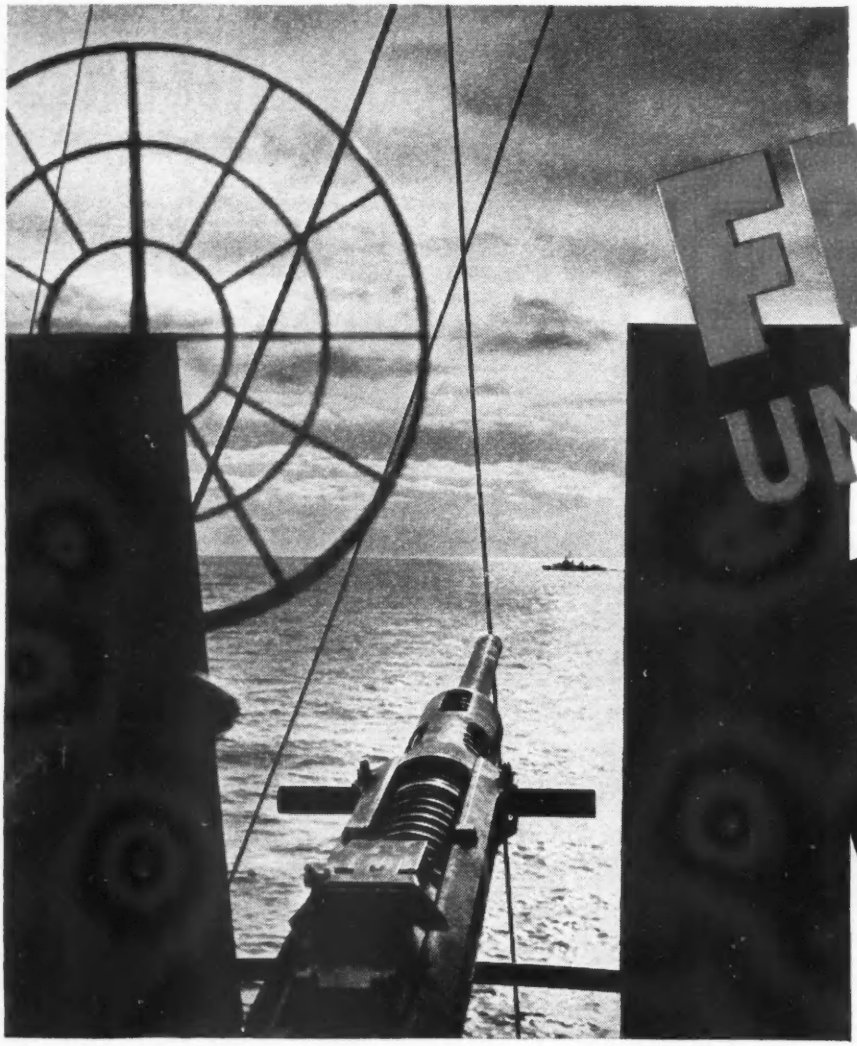
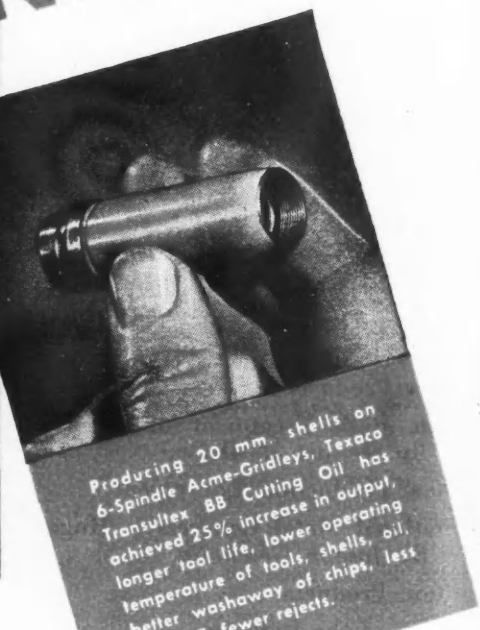


FLAK UNLIMITED



Producing 20 mm. shells on 6-Spindle Acme-Gridleys, Texaco Transultex BB Cutting Oil has achieved 25% increase in output, longer tool life, lower operating temperature of tools, shells, oil, better washaway of chips, less carry off, fewer rejects.

CAPABLE of firing 500 rounds a minute, this 20 mm. Oerlikon anti-aircraft gun and the ammunition to fire it are being produced in staggering quantities.

Chief contributor to America's modern miracle of mass production which is providing thousands of guns and billions of bullets is the use of present-day cutting coolants . . . foremost of which is TEXACO.

Texaco Cutting Oils permit higher speeds and feeds, assure increased output. They lubricate the tools, carry away heat, prevent chip welding, improve surface finish and tool life.

A Texaco Engineer specializing in cutting coolants is at your service through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

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★ *More revenue airline miles in the U. S. are flown with Texaco than with any other brand.*

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TEXACO

TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT — CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

IN THIS ISSUE . . .

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 89 November 1, 1943 No. 9

The Stuff That Jobs—Not Dreams—Are Made of

By Alfred P. Sloan, Jr.

THE challenge of the post-war period is jobs. But we cannot meet this challenge by adopting panaceas or by the conjuror's trick of pulling rabbits out of the hat. We have tried all that. It has failed us.

We must keep in mind that jobs are a result—not a means to an end—however desirable the objective may be. They are a result of the combination of capital, management and opportunity. The catalyst is a possible profit. The foundation is confidence in the future of enterprise as determined by national economic policy. Without these ingredients there can be no jobs in a free economy.

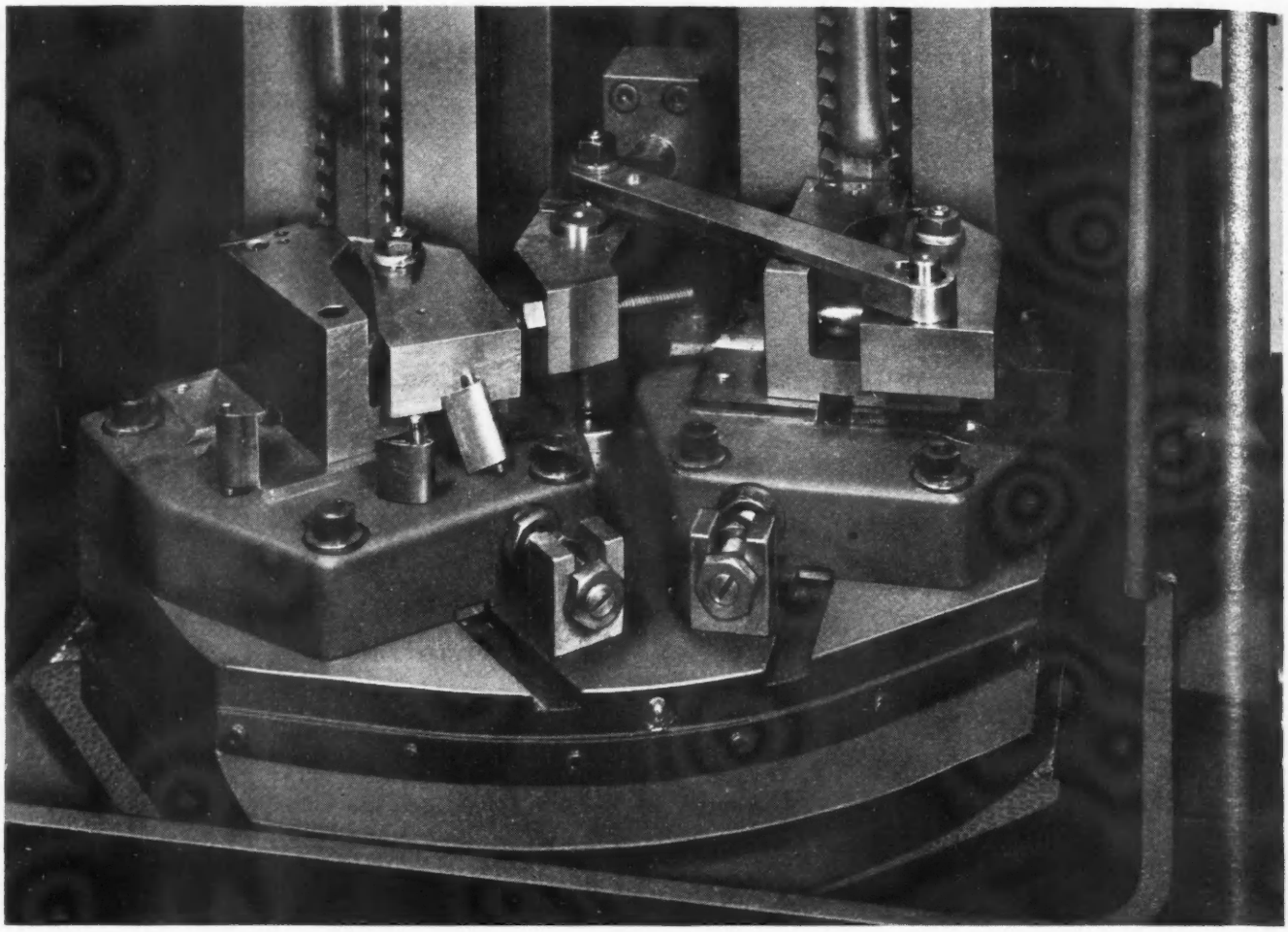
While management must actually do the operating job under our system of free enterprise, Government has a vital part in laying down national economic and fiscal policies to the end that the job has a fair chance of being done. At the advent of the war, existing national economic policies greatly prejudiced the expansion of enterprise. Our economy was frozen in a degree. This state of affairs has been lost sight of under the stimulation of the demands of war. Unless political wisdom prevails, similar handicaps will return to plague us and limit our possibilities when the war is over.

We should profit by past experience. We should do those things in a national way that will serve to encourage and stimulate enterprise in all its forms. The objective cannot be achieved otherwise. We must provide the necessary incentives. We must rebuild a foundation of confidence in the future opportunities of individual enterprise. Business cannot plan ahead with confidence if uncertainty exists as to the continuation of our existing economic system. Or if this system is to be hamstrung by those in power who believe in something different and act to prevent the system of competitive enterprise from working effectively. All obstacles along the highway leading to the maximum of job opportunities must be removed. It is not difficult to identify those obstacles, but it is quite another thing to develop a sufficiently widespread appreciation of their importance so that corrective political action may be insured.

From an address before the Economic Club of Detroit.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.



KNOWING HOW TO CONTROL CLAMPING PRESSURE

Solved this Turbine Blade Broaching Job

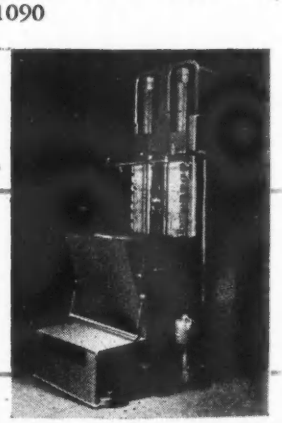
ONE of the problems in broaching turbine blades of the type tooled up in the above illustration is to clamp them with just the right amount of pressure. They are made of sheet metal, and too great a clamping force would crush them; too little would destroy accuracy or perhaps wreck the broach inserts. Realizing the need for a different approach, CINCINNATI Service Engineers designed the fixtures so that they are automatically operated—**clamped by spring pressure and unclamped by lever action,** thereby eliminating the variable human element.

The operation consists of broaching the trailing edge of three different turbine blades. With duplicate fixture and broach inserts, and one set of interchangeable details for each fixture, these blades are broached more accurately and to a better finish and at a far higher rate of production than the previous method. The job is handled on the smallest of the CINCINNATI Duplex Hydro-Broach line . . . the No. 1-30.

CINCINNATI Service Engineers have many years of experience in stepping up production, and bettering accuracy and finish by the broaching process, using their engineering skill and applying it to standard CINCINNATI machines. Many unusual types of parts are being broached on these machines. For typical examples, write for folder "How To Step Up Production on CINCINNATI Hydro-Broach Machines", No. M-1090

CINCINNATI

CINCINNATI No. 5-42 Duplex Hydro-Broach Machine. In all, there are seven sizes, specifications of which may be obtained by writing for catalog, No. M-894-2.



THE CINCINNATI MILLING MACHINE CO. CINCINNATI, OHIO, U.S.A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . CUTTER SHARPENING MACHINES

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

Volume 89, Number 9
November 1, 1943

By J. H. Marks
Chairman of the Contract Termination Committee of the Automotive Council for War Production

Contract Termination *in the Automotive Industry*

"IN TIME of peace, prepare for war," runs an old adage. The reverse also ought to be true: "In time of war, prepare for peace."

It is now apparent to all Americans that if we had been more willing to recognize our dangers in the years preceding Pearl Harbor, we would have been in far better condition to have proceeded with the war. By the same token, by recognizing the problems that will be encountered with the end of hostilities, we will be able to resume our peacetime civilian activity with much greater speed and much less disorder than if we overlook the problems until they are cascading down upon us.

At stake is how quickly jobs may be established in peacetime industry. Millions of men will be dependent for postwar jobs upon the resumption of production by the automobile and allied industries.

Our aim is to begin now to clear away the underbrush of confusion and uncertainties which threaten to retard swift reconversion of our plants when peace comes. In that way, we can get men back to work on civilian production with a minimum of dislocation to the economy of the nation.

The problem of reconversion is far greater in the automotive industry than in most industries. It is one of the few which completely suspended production of its civilian products and converted its production lines virtually 100 per cent to war. It swept its plant clean, uprooted its machine tools, and disposed of any equipment which stood in the way of all-out war production. The job of quickly re-establishing these production facilities and getting back into car production will be a formidable task under the best of circumstances. It is in the best interests of the nation, therefore, to get the ground rules laid now on problems involved in the termination of Government contracts so the reconversion job will proceed with a minimum of delay and confusion when the time comes to resume peacetime production.

"A problem well stated is half solved." Believing that to be true, the Contract Termination Committee of the Automotive Council for War Production has listed some of the problems common to most companies which are involved in the termination of war contracts.

First and foremost is how to get the plants cleared after termination. How to get the government-owned machinery moved out and how to arrange for the removal of other obstacles to the quick re-establishment of civilian production lines will be the key to the physical side of the job.

The second phase is how to get the money quickly into normal channels that would be tied up on termination of a given contract. Most manufacturers of war

(*Turn to page* 69, *Please*)

BECAUSE of the large number of war contracts cancelled to date, many of the problems discussed here by Mr. Marks are of immediate concern to American industry, and are not exclusively in the postwar realm. It is estimated that more Government prime contracts have been cancelled up to September 1 than were involved at the end of World War I. As some of these were in the automotive industry, the Automotive Council for War Production assigned a committee of top men, headed by Mr. Marks, Vice President of Packard Motor Car Co., to study the problem. Other members of the committee are:

K. J. Ammerman, Asst. to Pres., Borg-Warner Corp.

I. B. Babcock, Pres., Yellow Truck & Coach Mfg. Co.

J. H. Barrett, Sec.-Treas., Murray Corp. of America.

Albert Bradley, Exec. V.P., General Motors Corp.

E. R. Breech, Pres., Bendix Aviation Corp.

W. P. Brown, Pres., Briggs Manufacturing Co.

D. J. Buell, Pres., Buell Die and Machine Co.

C. C. Carlton, V.P.-Sec., Motor Wheel Corp.

E. A. Clark, V.P., Budd Wheel Co.

B. E. Hutchinson, Chairman of Finance Committee, Chrysler Corp.

H. L. Moekle, Sec.-Asst. Treas., Ford Motor Co.

M. L. Peale, V.P., Republic Aviation Corp.

A. M. Wibel, V.P., Nash-Kelvinator Corp.

Diversification of W

The buffer rod has a long blind end bore which is honed to a tolerance of 0.0003 in. This bore is checked with the Sheffield Precisionaire gage equipment shown here.

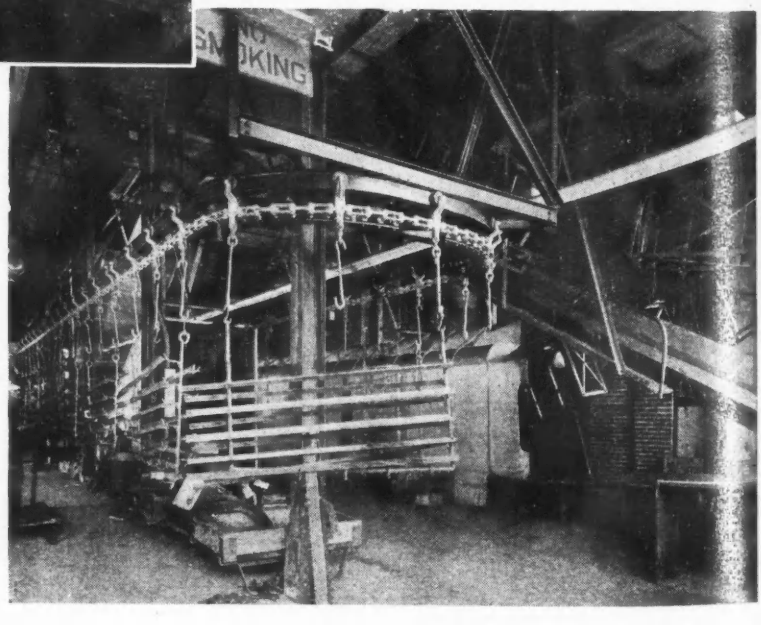
STRIKING example of a before-and-after sequence is found in comparing the current activities of the activities of the Minneapolis-Moline Power Implement Co., with the plant as it was some years ago when the company first embarked on a flexible manufacturing program incident to the launching of the line of Model Z tractors. Our readers are invited to compare M-M's war-time activity with what the writer described in Auto-Motive Industries, August 7, 1937, in an article entitled, "Production Setup at Minneapolis-Moline Promotes Flexibility."

Under the guidance of its president, W. C. MacFarlane, the organization started a long range planing program long before our entry into the war. This resulted in a complete re-alignment of plant facilities and building layout and, eventually, created a diversification of war product activity on a really amazing scale for a company of its size. This will be evident as our study unfolds.

Generally speaking, the original plant facilities have been vastly improved by razing the ancient office building and adding a new office building as a part of the factory structure, producing, in effect, a long continuous plant which lends itself admirably to straight line manufacturing methods particularly as to assembly facilities. As new war products were added to the roster, the management skillfully acquired many new items of versatile general purpose ma-

(Above)

Latest acquisition is this huge Cincinnati cylindrical grinder, used at present for grinding large shafts. It will be used later for crankpin grinding.



(Right)

Here is the Flow-Coat painting installation designed and built by M-M. The spray station at the entrance of the tunnel is cleverly arranged with a multiplicity of automatically controlled spraying nozzles which reach every section of the work including interior areas. Amazing feature of this equipment is the variety of sizes of work and shape of parts that can be thus handled.

War Products at Minneapolis-Moline Plant

By Joseph Geschelin

chinery of the latest types so that they now have a nucleus of the finest manufacturing equipment known to the art.

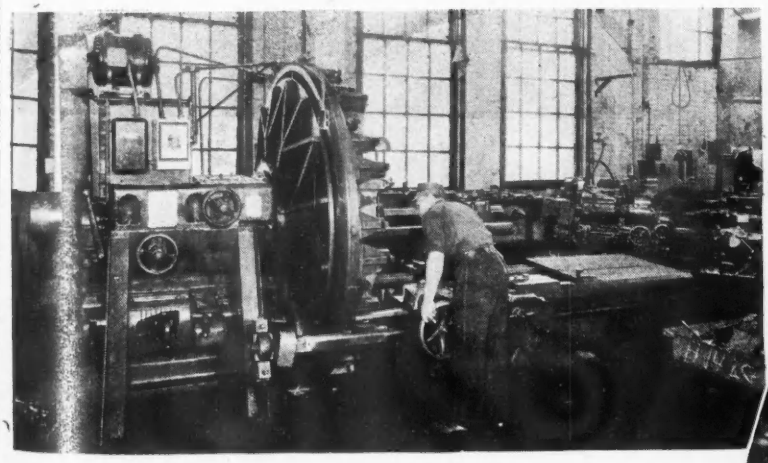
Good seeing has been promoted by the introduction of an excellent system of fluorescent lighting in every department. Coincident with this, materials handling has been modernized with the adoption of craneways, hoists, industrial trucks of every description, Matthews gravity roller conveyor systems, and monorail conveyor lines.

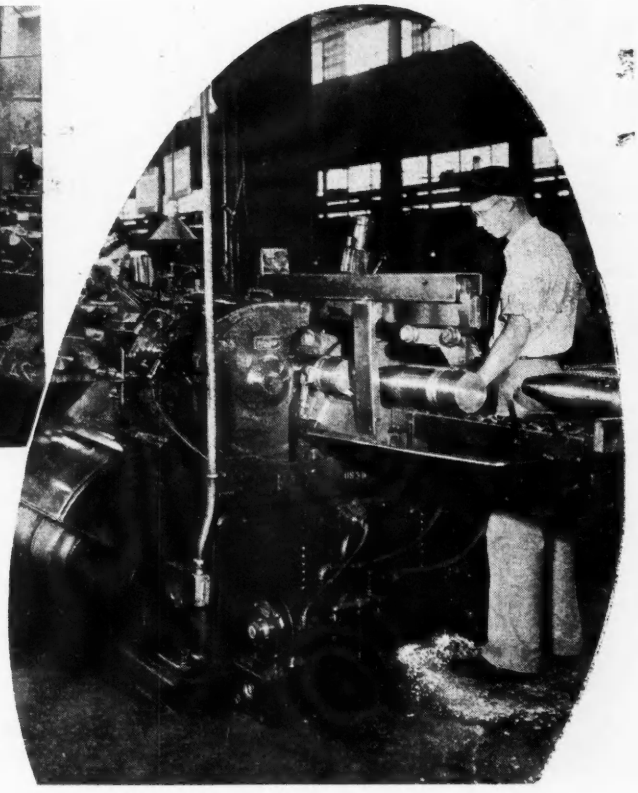
Most impressive aspect of the current program, to the writer, is the fact that here is a major project that has been carried out without resorting to the construction of new buildings. With each phase of expansion the management impressed into active service numerous old or abandoned buildings which have been suitably rehabilitated, painted, and equipped. Consequently, the overhead burden to the organization and to the taxpayers, as well, has been held to the very minimum.

Moreover, wise planning with a view to the future has minimized the post-war reconversion problem to a remarkable degree. Here is one organization whose peacetime products could be started in normal production with but little change from the basic setup that exists today.

Looking at it another way, M-M bids fair to revolutionize its pre-war product by drawing upon the methods of precision manufacturing so essential to the production of war-time materiel. We refer particularly to the introduction of precision boring,

This is the Eighty-seventh in the series of monthly production features



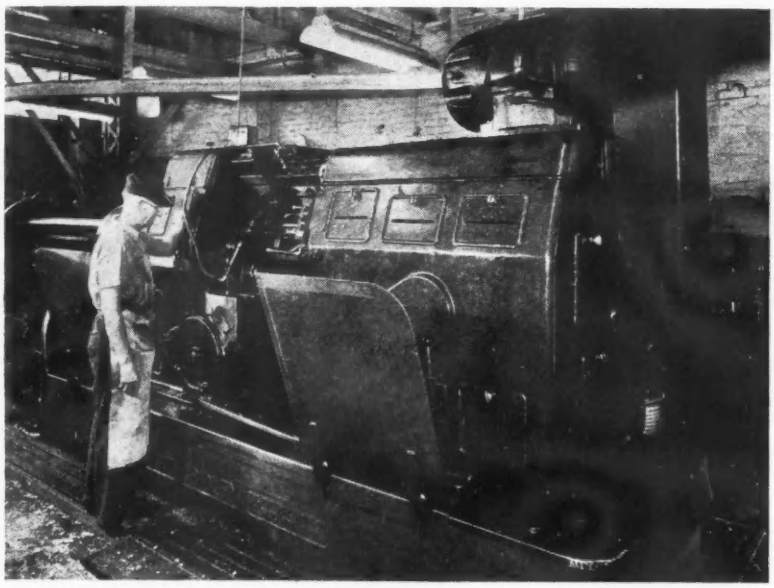


(Above)

Outstanding example of improvisation at M-M is this old lathe which has been fitted with a large drum type fixture for holding Bofors gun "shovels". Heavy boring bars, fitted with single fly-cutters do the roughing and finish turning of the large diameter contour.

(Right)

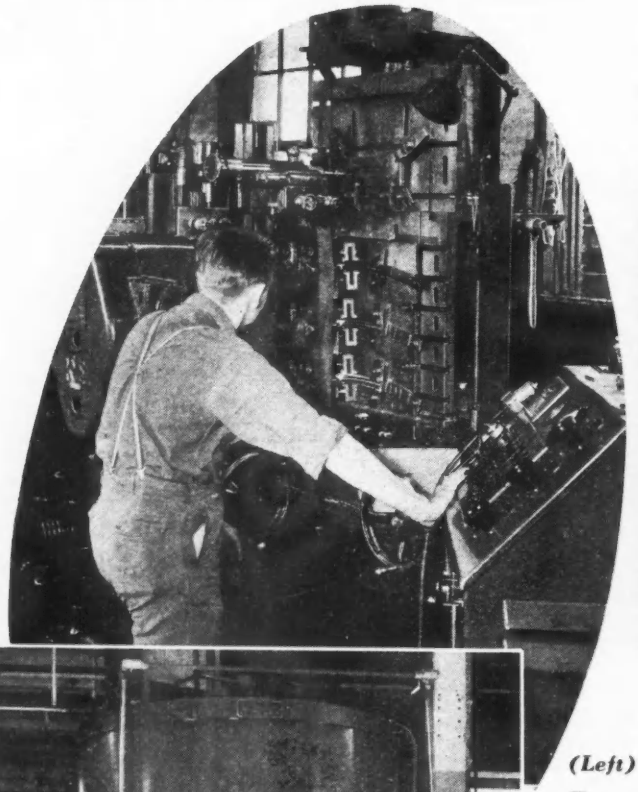
Cincinnati Centerless grinder—of latest type—is used for finish grinding of 155 mm shell contour.



Largest machine in the screw machine department is this general purpose, four-spindle, 3½ in. National Acme-Gridley automatic

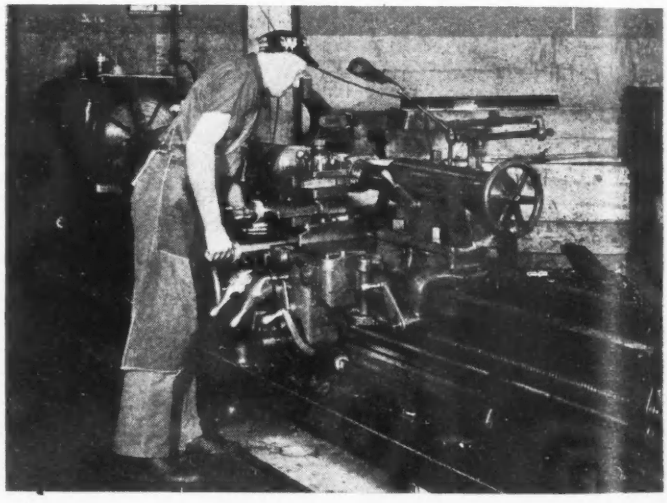
centerless grinding, honing, etc., which can be adapted to the building of farm equipment. Quality control methods introduced concurrently — the Sheffield shadowgraph and Sheffield Precisionaire, in particular—also will influence post-war methods.

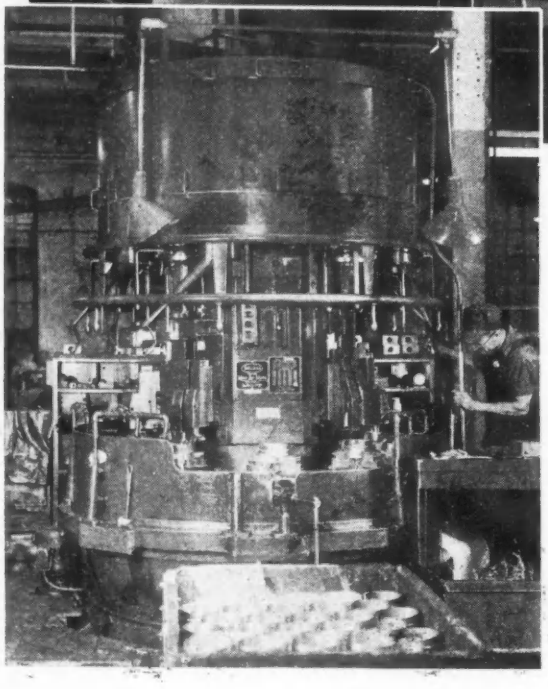
Special attention is drawn to the skill of the factory management in the art of improvising many of the special setups found at every turn. They have rebuilt old machines and fitted them with



(Oval)

P & W Keller profiling machine is set up in the Bofors department for the forming of intricately shaped parts, handled three to four at a time.





(Left)

Here is one of several of the big Bullard Mult-Au-Matics installed in the Bofors department.

(Right)

A general view of the engine assembly line on which engines are handled on special stands on the gravity roller conveyor. Note the fluorescent light sources at the ceiling and the portable tools suspended from Chicago - Pneumatic balancers.

Another recent acquisition of fine production equipment is this 22 in. Lodge & Shipley manufacturing lathe, one of a battery.

special heads and fixtures for specialized operations to avoid the use of special purpose equipment. They have developed special methods for painting and cleaning sheet metal. In the foundries they have taken advantage of the latest techniques and equipment and have added touches of their own, such as the rebuilding of conventional core-blowing machines to blow cores of unusual length and form.

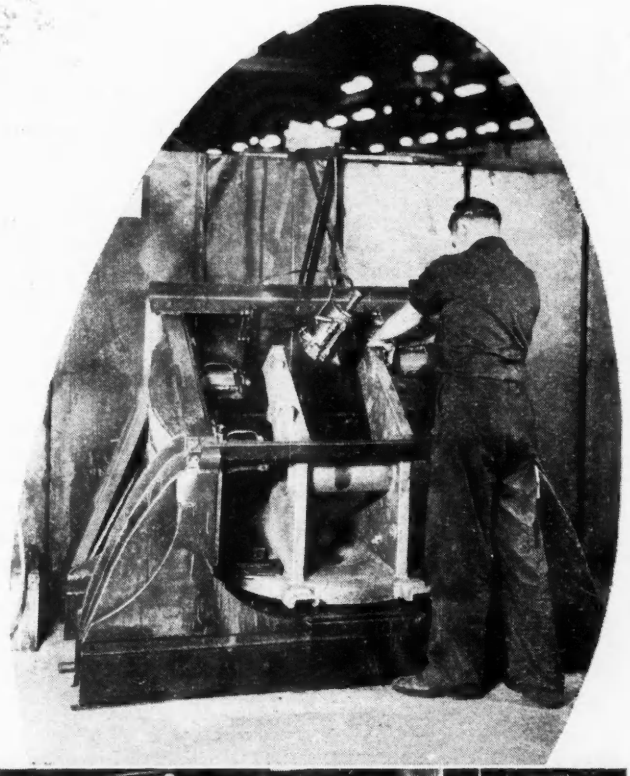
Cemented-carbide tooling is employed extensively, the best example being the tooling for the 155 mm. shell which uses special steel cutting grades, to the exclusion of conventional tools. According to the management of the M-M Comco plant, the machining of these large shells would be virtually impossible—at least at the rate required for this War—without the use of cemented-carbide tooling.

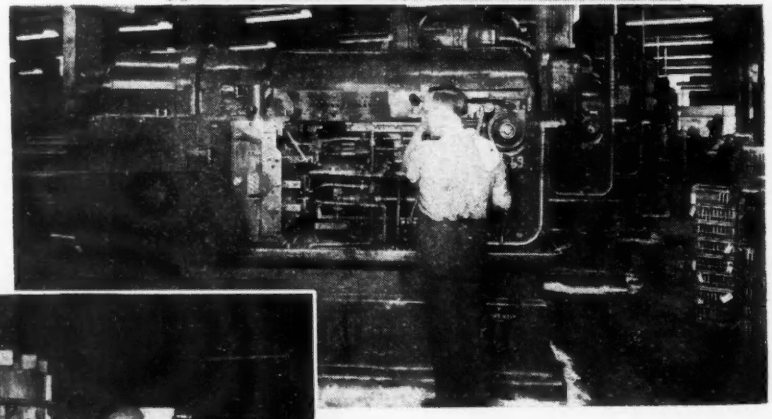
Coming to the high-spotting of plant facilities, consider first the main tractor building. Here is a new set-up for building M-M tractors which have been authorized for production, albeit on a reduced scale. This is a continuous straight-line layout, far superior to the former layout, featuring conveyorized assembly lines for final tractor assembly and for engine assembly. Engines are assembled on a Matthews gravity roller conveyor. One of the innovations on the tractor assembly line is the installation of a huge DeVilbiss downcraft spray booth through which the tractors move while suspended from a monorail conveyor. From the spray booth the tractors move through a drying oven also built into the line.

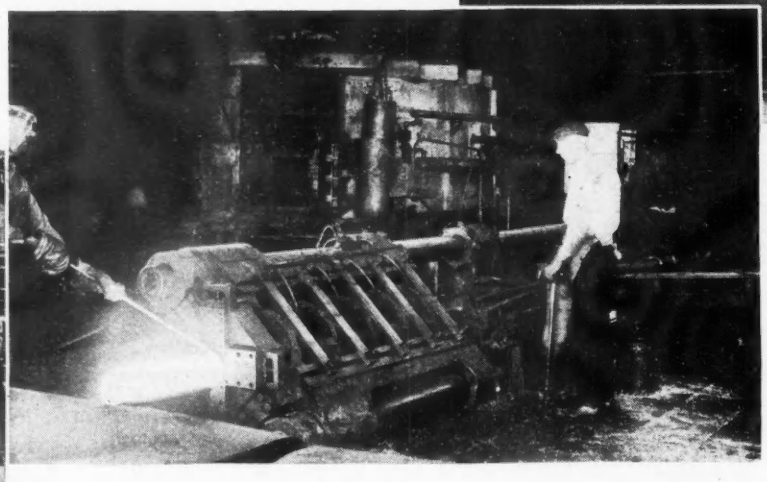
With the exception of re-arrangement of equipment and the installation of some new machinery, the manufacturing departments for tractor parts remain about the same. Among the new items of equipment is a huge Cincinnati hydraulic external grinder used for grinding large shafts and large crankshafts. Lathe facilities, too, have been enhanced with a large battery of Lodge & Shipley manufacturing lathes. Another important item is a new Blakeslee Niagara washing machine used for cleaning tractor cases.

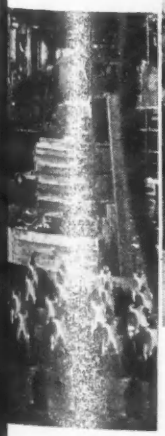
A goodly section of the normal tractor

View of the welding department of Hopkins plant: the top carriage is a massive fabricated structure, welded in the Lincoln welding machine booths. After the welding operations have been completed, the unit is fitted in this huge fixture where it is straightened to the proper alignment by means of automotive type hydraulic jacks.







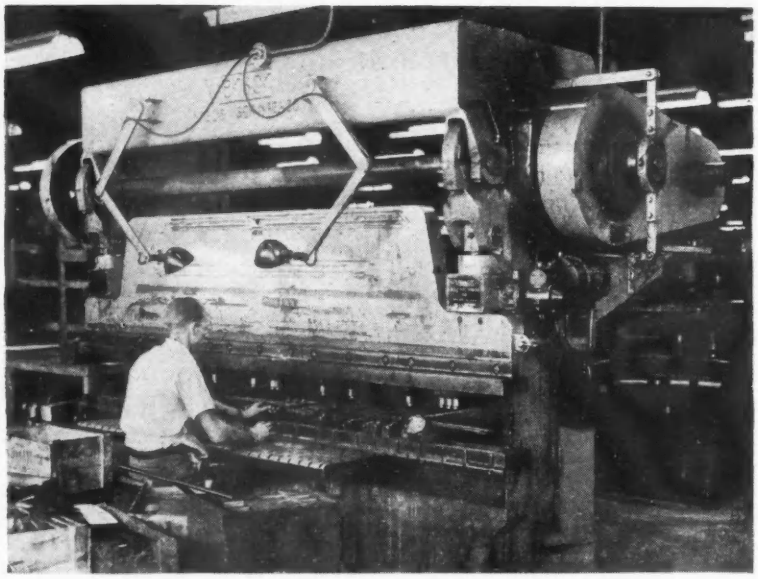


(Above)

Large battery of 1⅞ in. Conomatics is found in the Comco ordnance plant for the turning of 20 mm shot blanks.

(Left)

Outer formation of 155 mm shell blanks is done in this massive horizontal Baldwin - Southwark draw press fitted with a series of draw rings which may be plainly seen in the foreground.



(Left)

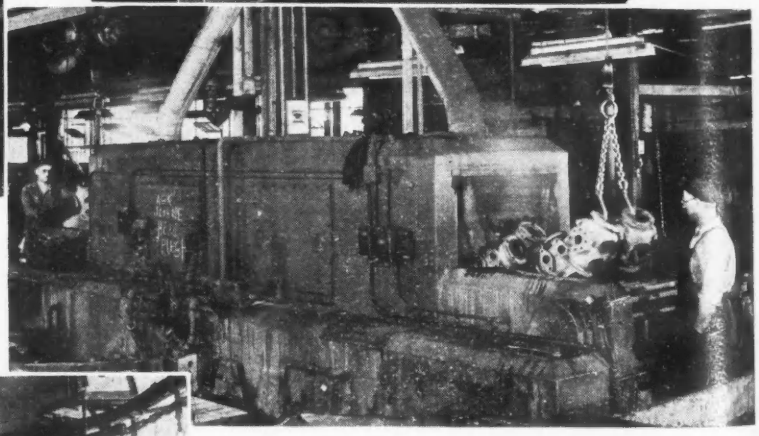
In the Hopkins plant press shop—a familiar Verson All-Steel narrow bed press used as a press brake and punch.

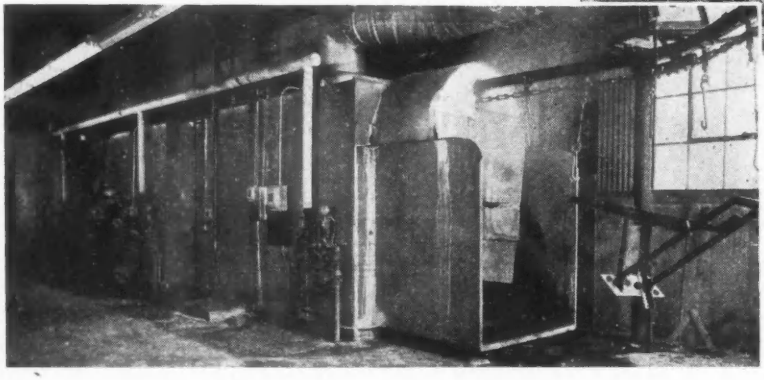
(Oval below)

Quality and quietness of M-M transmission gears have been greatly improved since the installation of a battery of the familiar Red Ring noise checking machines.

(Above)

Latest type heavy duty Barber-Colman gear hobber is a recent addition to the gear cutting department at M-M.





(Above)

A number of Blakeslee washing machines are found in various departments of the M-M plant, this one being used for the cleaning of tractor and winch cases.

(Left)

Prior to Flow-Coat treatment, parts such as the one shown at the entrance on the conveyor are chemically cleaned in this large International Conveyor & Washer unit.

building facilities has been set aside for mass-production of large power winches built for the Maritime Commission. Two of the largest sizes of these units for use on merchant vessels are being built for the first time by mass-production methods. Parts for these are machined on the same equipment as is used for engine production.

In addition to the winches, the tractor building also has sections devoted to the production of Bofors gun parts. Featured in this set-up is a Keller profiling machine for the roughing of intricate slots and formations in gun elements. An excellent example of improvisation is the huge drum type fixture installed on an old lathe and used for boring a large diameter curvature on certain Bofors gun parts. Boring is done with a massive boring bar fitted with a flycutter. It can be appreciated that a specialized machine for this purpose would have cost many thousands of dollars, if, indeed, it could have been designed and built in time to be of value in the current program.

At the time this article was written they were installing one of the new Ingersoll milling machines of huge size to supplement available milling facilities. Several Bullard Multi-Au-Matics have been installed in the Bofors department.

Among the many machine shop departments in the tractor building are—a large turret lathe department provided primarily with several types of Warner & Swasey lathes; a large screw machine department with National Acme-Gridley automatics, including a new four-spindle 3½ in. machine; a comprehensive gear department containing Fellows gear shapers, G & E gear hobbers, a battery of Barber-Colman gear hobbers including one of the latest of the heavy duty B-C hobbers. In addition, the gear department boasts a number of the familiar National Red Ring noise testing machines which have exerted a profound influence upon the production of quiet gearing at M-M.

At the time this article was written, M-M was in the process of completing the installation of a compact and self-contained department for the machining of connecting rods. This department exemplifies the latest methods known to the art.

The tractor building group also includes its own cast iron foundry, modernized in many respects in recent years. The mechanized pouring line on a continuous conveyor features a new sand slinger for flask molding operations, which is a great improvement in charging floor operations. The sand slinger is contained within the pouring conveyor, molding being done on a small circular conveyor moving around the slinger outlet. Another of the new features is a large vertical type Mahr core baking oven installed several years ago.

Several types of "buffers" for Bofors guns are produced in a self-contained setup installed in a small building, used originally as a garage. This is a self-sufficient plant provided with the most modern machinery for handling precision metal cutting operations. Large Barnes Drill Co. Hydram drilling machines are used for boring the buffer body forging. A Barnesdril honing machine fitted with Micromatic tools is employed for the honing of the buffer body bore as well as the fine long blind bore in the buffer rod. The latter bore is held to 0.0003 in. The Sheffield Precisionaire gage is used for checking bores. This plant also boasts a battery of the familiar Monarch lathes of several sizes.

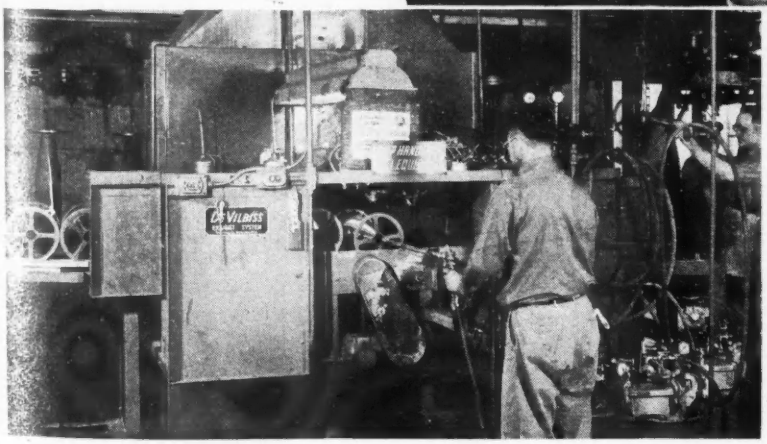
Speaking of precision operations, the tractor engine has been greatly improved as to quietness and operating efficiency by the introduction of Heald precision boring of valve guide bores.

(Oval)

General view of the M-M tractor assembly line in its early stages. The conveyor continues to the final completion stage, terminating with a paint spray booth.

(Below)

DeVilbiss spray booth for automatically spraying 155 mm shells. Note the cradle mounting of the shell to permit rolling while under the spray nozzles. Shells are washed in an adjacent DeVilbiss washer. Note also the monorail conveyor system for transporting shells and serving as a drying station as well.



The tractor department also boasts a large Parkerizing unit which is used for the finishing of many parts used in the variety of products made by this company.

M-M Comco Ordnance Plant

Divorced from the tractor division is the ordnance plant, located in two buildings about six miles removed from the main plant. The smaller building, formerly a carpenter shop, is set up for the mass production of 20 mm shot. The larger building, a structure idle for many years and acquired from its owners, houses an outstanding operation for the production of 155 mm. shells directly from forging billets.

Consider first the production of 155 mm shells. This starts with large billets which are cut into stock sufficient for the formation of two shells, using Airco torches set up on a conveyor track. The cut sections then are nicked at the center on another Airco station, cooled by water-spraying in a station on the conveyor, then sheared on a 500-ton Baldwin-Southwark press. Shell blanks then are heated in a large Johnston rotary furnace, de-scaled in a water tank under pressure of 125 psi, and proceed to a 300-ton Baldwin-Southwark press for the initial piercing operation.

The outer formation of the shell is produced in a long horizontal Baldwin-Southwark draw press, using a series of draw rings. The trepanned interior then is shot blasted on the inside in a Pangborn automatic machine. The forging is now accurately centered at the closed end and rough-turned on the OD in massive

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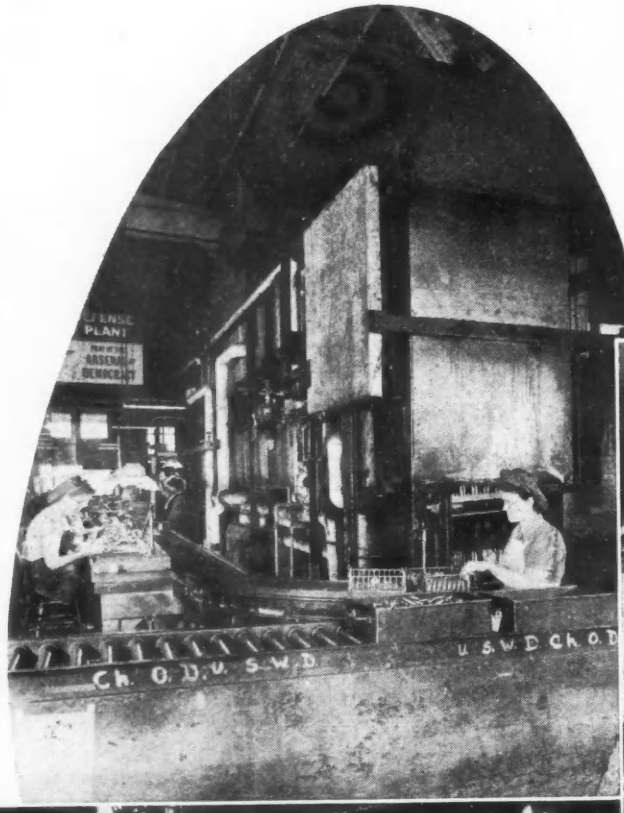
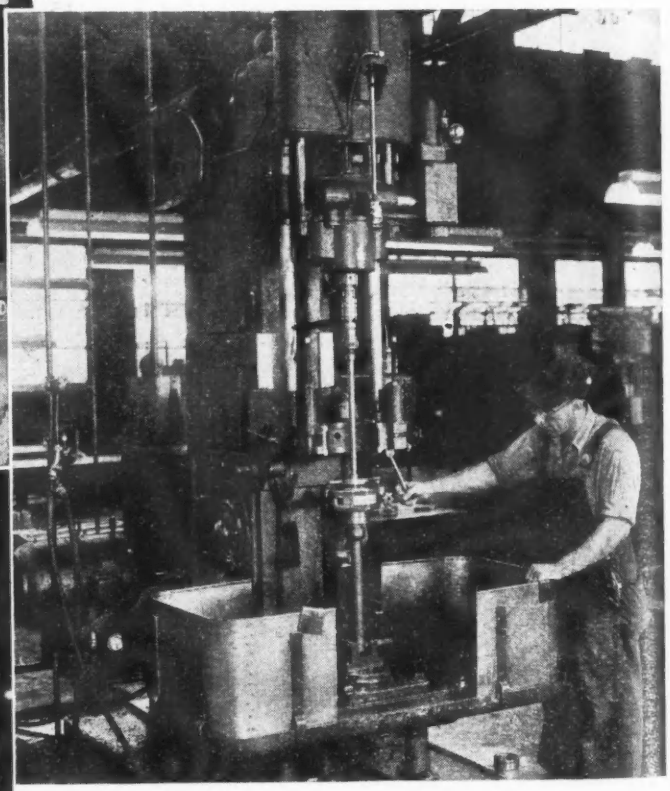
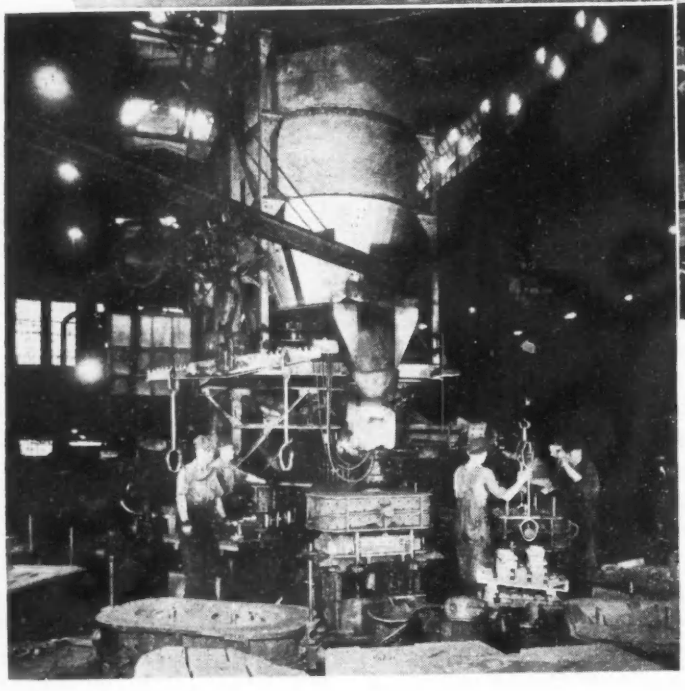


Prize exhibit in the 20 mm shot plant is this tiered type shock testing machine, employed for subjecting finished shot to alternate immersion in cold and hot water baths. Conventional practice is to spread such baths horizontally but the Ordnance plant is too cramped for space to permit anything but a special floor space saving installation.



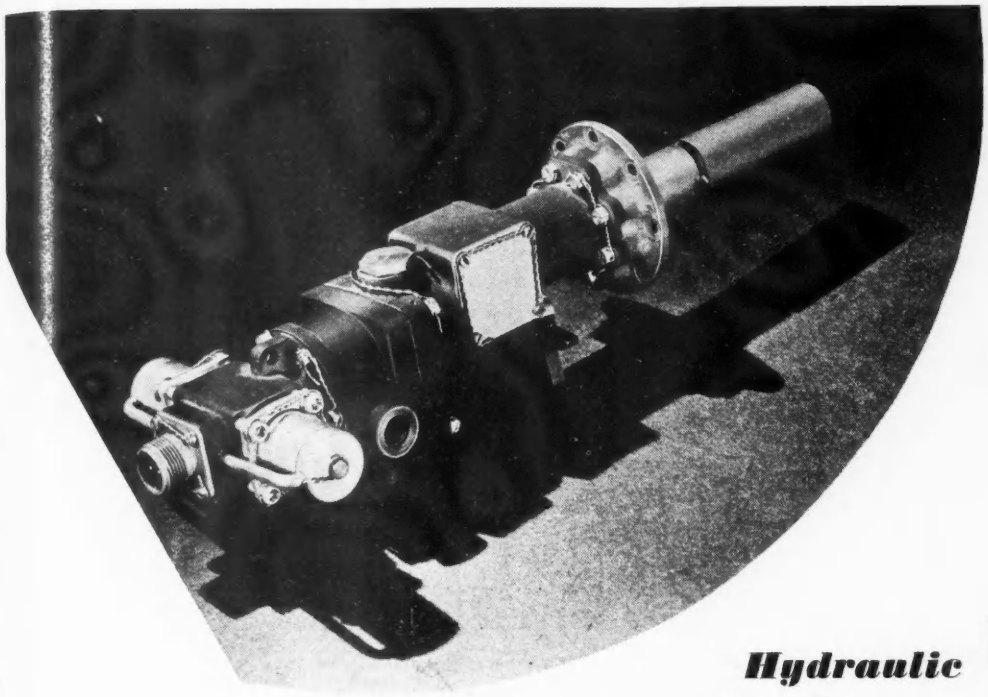


(Above)

This Barnesdril hydraulic honing machine fitted with Micromatic hones is located in the Bofors buffer department for the honing of the buffer body as well as for honing of the fine long blind bore in the buffer rod.

(Left)

New sand slinger in the main foundry improves quality and increases productivity of the molding line. The flasks are mounted on a small circular conveyor line around the sand slinger.



Hydraulic type temperature control for engine lubricating oil or coolant.

By
William A. Ray
Chief Engineer,
General Controls Co.

Hydraulic Control *of Aircraft Engine* Temperature

THE part played by hydraulic control mechanisms in steadying temperatures in aircraft power plants is an important one, from the standpoints of both safety and efficiency. The aircraft engine, possessing one-sixth the weight per horsepower of its earth-bound twin, the automobile engine, and subjected to mercilessly greater and more rapid changes in load and atmospheric conditions, needs the constant attention of a sensitive, quick, forceful but restrained temperature regulating apparatus.

The design of aircraft engines for high work rates makes it imperative to dissipate substantial amounts of heat through the lubricating oil, in both liquid-cooled and air-cooled engines. Thus, the lubricating oil, distinctly a cooling agent and subjected to extremes of temperature, may catch fire at one extreme yet freeze to a solid at the other. The heat in the oil is usually dissipated through a radiator which in turn is subjected to the atmosphere through which the plane is flying.

Hydraulic controls are being successfully applied to the positioning of adjustable flaps which control the flow of air past the oil radiator and, in liquid-cooled engines, past the main radiator. The ease with which the automatic temperature control can be adapted to the usual flap operating gear also makes it possible, in most cases, to readily switch back to manual control for those times when only human perception decides the best condition, such as for take-off, landing or fast warm-up. Thus, if desired to minimize head resistance as when taking off heavily loaded ships, flaps can be retracted more than usual; or when landing, when head resistance may be desirable, flaps can be opened more than the usual amount.

Hydraulic operation is felt admirably adaptable to most temperature applications and readily lends itself to constant operation without destruction to either control valves or operating cylinders, has very few moving parts, and the weight is well in line. Hydraulic operation has further advantages in that in most cases of system failure, the flaps will fair or trail. Although maximum engine power is not always obtainable with faired flaps and retirement from combat may be necessary, sufficient engine power is available for safe operation of the airplane.

The selection of hydraulic oil as the work-doing medium resulted in the initial development of a temperature control that is adaptable to either lubricating oil or engine coolant. This particular control is operated by a sensing element or thermal element of the liquid expansion type. This element was selected because of its great work-doing possibilities compared to other types of sensing elements, such as bi-metal expanding or bending members, thermocouples, vapor-tension or gas expansion. A liquid element is particularly suited to aircraft work in that it is not responsive to altitude conditions, hence holds its temperature calibration regardless of atmospheric pressure, provides a hard working force, and in general, does not require compensating means or glands. Development work has additionally overcome the slowness of response of this type of unit to where it is comparable as to the time of response, for example, with bi-metal immersed directly in the fluid.

This liquid-charged element operates a four-way

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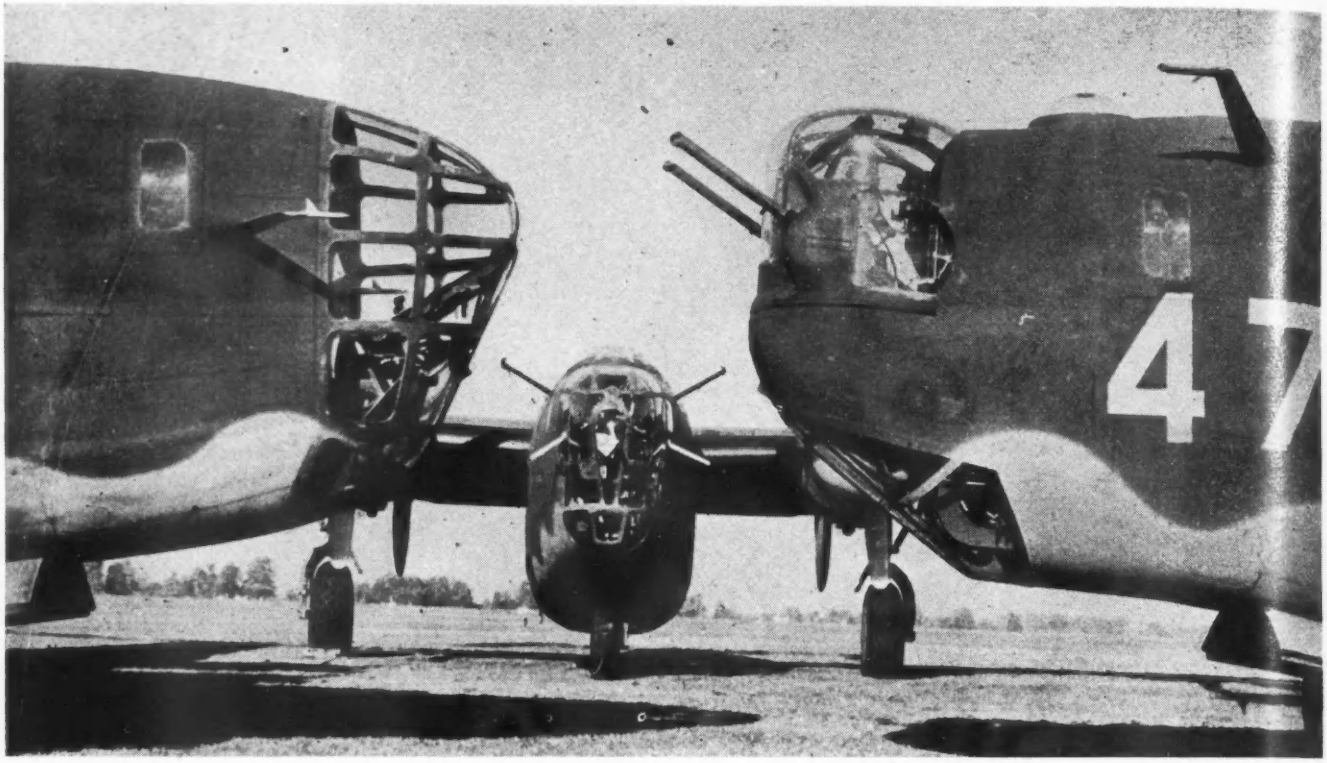


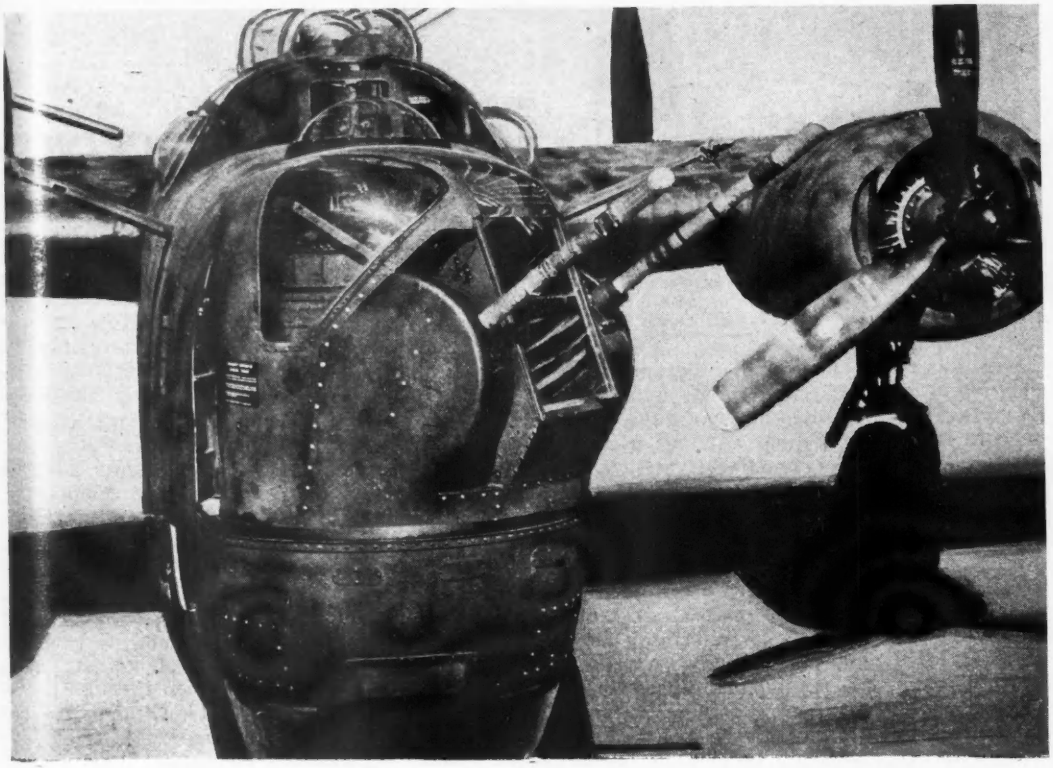
The production model of the first Ford Liberator (left) had one machine gun in the nose, the next design carried three guns (center), and the present bomber in production has an electric turret. The bombardier's compartment is located beneath the new nose turret. (Acme photo.)

New Turrets

AMONG the major improvements now being incorporated in American heavy bombers are nose and chin turrets to give them greater protection against frontal attack, a favorite tactic of enemy fighters in recent months. Photographs of the new turret installations are shown on these pages.

The flying Fortress B-17G model in production at the Boeing, Vega and Douglas plants on the West Coast has acquired a power-operated chin turret equipped with two .50-cal. machine guns, which in-

Liberator bombers now going to the fighting fronts are equipped with retractable Sperry ball turret (two .50-cal. guns) as shown in this photo. (Rudy Arnold photo.)

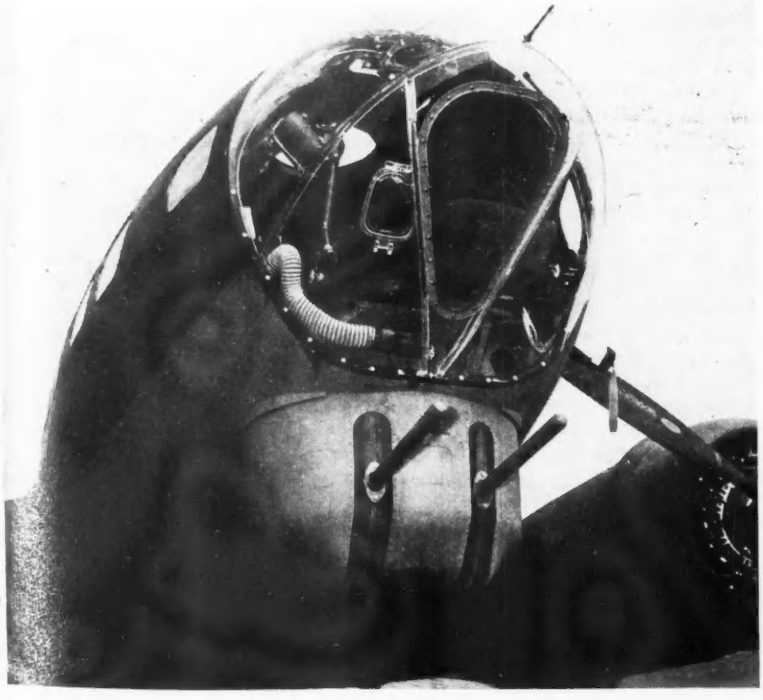


The Emerson electric turret with two .50-cal. machine guns as installed in the nose of a Liberator B-24 bomber, which is armed with 13 guns, including four turrets with two .50-cal. guns each. (Rudy Arnold photo.)

on American Heavy Bombers

crease the armament of a Flying Fortress bomber to 13 guns—four twin-gun turrets and five single guns in various parts of the plane. Armament of the new Liberator B-24 bombers built by Consolidated and Ford consists also of 13 guns, including a twin-gun electric turret that has been added in the nose.

To provide better protection for the pilots and other members of the crews, Flying Fortresses of the U. S. Army Eighth Air Force are having stronger cockpit glass panels installed in them in England. The new glass panel, a British development which is made of five sheets of plate glass of varying thickness with four laminations of plastic between them, has a total thickness of approximately 1½ in. and will withstand against complete penetration, the impact of a .30-cal. bullet fired from a service rifle at 100 yards. The panel weighs about 18 psf.



A closeup view of the new chin turret underneath the bombardier's compartment on the Flying Fortress B-17G model. At the bottom of the compartment can be seen the warm air duct to the bomb aimer's window.

Future Car Designs *as Forecast*

THAT the next passenger cars to roll off the assembly lines of America's automobile factories will be substantially the same as the 1942 models is a generally accepted fact and although a wide divergence of opinion exists among automotive engineers as to the new developments that eventually will be incorporated in cars of the future, there is considerable agreement that improvements in design from year to year will be gradual as in recent models. Many extreme ideas being advocated today are really only in the embryonic stage in so far as their introduction at low cost in production cars. Then there is evidence that the national economy after the war will accelerate functional design and result in emphasis on economy cars rather than glamour cars. In other words, future car design will be determined to a large extent by how much the public can afford to pay for motor transportation.

Various phases of designs were analyzed by prominent automotive engineers at a symposium on cars of the future sponsored recently by the Metropolitan Section of the Society of Automotive Engineers in New York City. Close to 700 engineers and other company representatives attended the meeting, which was in charge of Chairman Harold F. Blanchard. Topics receiving most attention in the papers included car weight, location of powerplant, engine developments particularly with respect to high octane fuels and superchargers, transmissions, and the possibilities for aluminum and plastics.

Floyd F. Kishline, chief engineer of Nash Motors Division, began the symposium by presenting the replies of a large number of engineers to a questionnaire, during which he also expressed his viewpoint on some questions. He pointed out that the survey did not indicate that any work is being done on passenger car design by these engineers, but that all are devoting their full time on the war effort. A few highlights from answers follow:

Cars following the postwar models will be redesigned gradually incorporating a lower price, lighter weight, and slightly smaller size.

The American public will not be satisfied with the ride aspects of a car designed to seat 4 or 5 passengers when the empty weight of the car is less than 2400 lb., certainly not less than 2000 lb.

Some suggestions offered for improving automotive power plants consisted of fuel injection, water jacketed crankcase, better manifolding, higher speeds, air-cooling, low speed engine with proper gear ratios, smaller engine with cut-in supercharger, and sodium cooled exhaust valves in high compression engines.

Improvement in fuel mileage can always be obtained by cutting the silhouette of a car, by reducing weight, and by reducing horsepower of the engine. To use high octane fuels, objectionable lead deposits must be eliminated that result at low engine speeds with over 2 cc of tetraethyl lead per gallon.

Automobile design problems after the war will be quite different from those in prewar days, it was stressed by Delmar G. Roos, vice-president and chief engineer of Willys-Overland Motors, who gave an excellent discussion on what will confront engineers when they must give much greater consideration to the economics of design due to the higher wage levels, taxation and cost of materials. The popular "dream" cars are impractical today in numerous ways and the public should not be aroused about something that is so far ahead, he stated. In discussing the use of aluminum extensively in cars, he cautioned against being too optimistic, citing its modulus of elasticity and coefficient of expansion as being contributory at extreme temperatures to increased noise in component parts made with it.

He also gave some interesting results that have been obtained with high octane gasoline. Using 100 octane gasoline in a modern conventional automobile engine, considerable lead ash collected on the pistons at light loads. By increasing the compression ratio from 6.5 to 7 to 1 a maximum fuel saving of eight per cent resulted and over the entire operating range the fuel consumption was reduced five per cent. Above a 7 to 1 compression ratio roughness became a problem. Greater possibilities of getting more fuel mileage is foreseen through transmission development, including the use of overdrive mechanism.

Abstracts of four papers read at the meeting are presented herewith:

Automobiles to Come

By R. E. Cole, Vice President-Engineering, Studebaker Corp.

IT HAS been the experience of other industries, as well as the automotive industry, to note that the public is slow to accept radical changes. This has been proven time and again by companies that have stepped out so far in front with an article that undoubtedly had many good features from an engineering standpoint, but was so radically different in appearance or in some mechanical features from that which the public has been accustomed to seeing and operating, that they are always suspicious. There are always a few people and individuals who are willing to take a chance on anything new, but these buyers are so limited that the wisdom of producing an article of this kind is always questionable.

Many articles have been written and published that leave in the public mind the idea that they are going to see an automobile equipped with a small high-speed engine, burning 100 octane gasoline and giving 40 to 50 miles per gallon. This is certainly a wonderful idea and may some day come to pass, but it is very doubtful if anyone in the industry is going to be inveigled into designing an engine of this type to burn only a premium fuel, of which it is very questionable if there would be more than a limited amount produced and that with a very limited distribution. From experimentation that has been carried on, to date nothing has been proven that will tend to show enough of an increase in fuel economy to warrant the premium paid for the fuel or the expense necessary to develop and tool up an engine of this type in the immediate future. It would seem there are many ways to improve fuel economy on present day power plants and, at the same time, enable them to burn either premium or non-premium fuels.

We often hear the question from the public—"How about so and so's new low priced automobile, to be sold at $400 or less?" This may be possible, but it should be borne in mind that labor and material are still the prime factors in car cost, and since it takes approximately as many manhours to produce a small car as it does a large one, the cost saving can only come in material which, when measured in dollars and cents, represents only a small saving at the expense of sacrificing comfort. It may be mentioned also that labor and material costs have advanced to new heights, with the result that postwar products will be priced higher.

Much has been written about the possibilities of rear-engine-drive cars. There is much to be said for and against rear-engine design. This is purely an engineering problem. It is hardly conceivable that it makes any difference to the public whether the power plant is in front, rear, or under the seat, so long as the vehicle is reliable, safe to drive, and comfortable.

by Automotive Engineers

The main thing to be considered in locating the power plant are passenger comfort, accessibility, reliability, and cost.

Economy of operation and weight reduction, which really go hand in hand, should not be too hard to accomplish, assuming, of course, that, in the postwar period, such materials as aluminum, plastics, new steels allowing thinner gages to be used, etc., will be available at a price which will permit their use. Engineers have always been trying to reduce weight, which is the most practical way to effect economy of operation. It has been found difficult to accomplish this beyond a certain point, due to the fact that on some of the lighter weight materials the price has been prohibitive.

Passenger Comfort—There are many ways that passenger comfort can be increased without greatly increasing the cost of the vehicle such as more headroom, more comfortable seats, improved ventilating systems, better vision, easier ingress and egress, better insulation against excessive heat and better mechanical control, which will be accomplished by improved automatic or semi-automatic clutches and transmissions, and a general cleaning up of the whole interior or passenger compartment.

Improved Appearance—Door handles, bumpers, radiator grilles should be functional and should be submerged in such a way as to become a part of the entire automobile, rather than something that is suspended on a hook. The tendency to eliminate the running board, if handled properly, should entirely eliminate fenders and running boards, as such.

Accessibility and Serviceability—Instead of tacking on an accessory here and there, practically all the items going to make up the car could be designed into the product as a whole, incorporating them into the machine as a part of the finished product. Serviceability should also receive major attention.

Of course, any design being thought of today is going to be governed more or less by economic conditions that will exist after the war.

Postwar Possibilities of Air-Cooled Engines in Automobiles

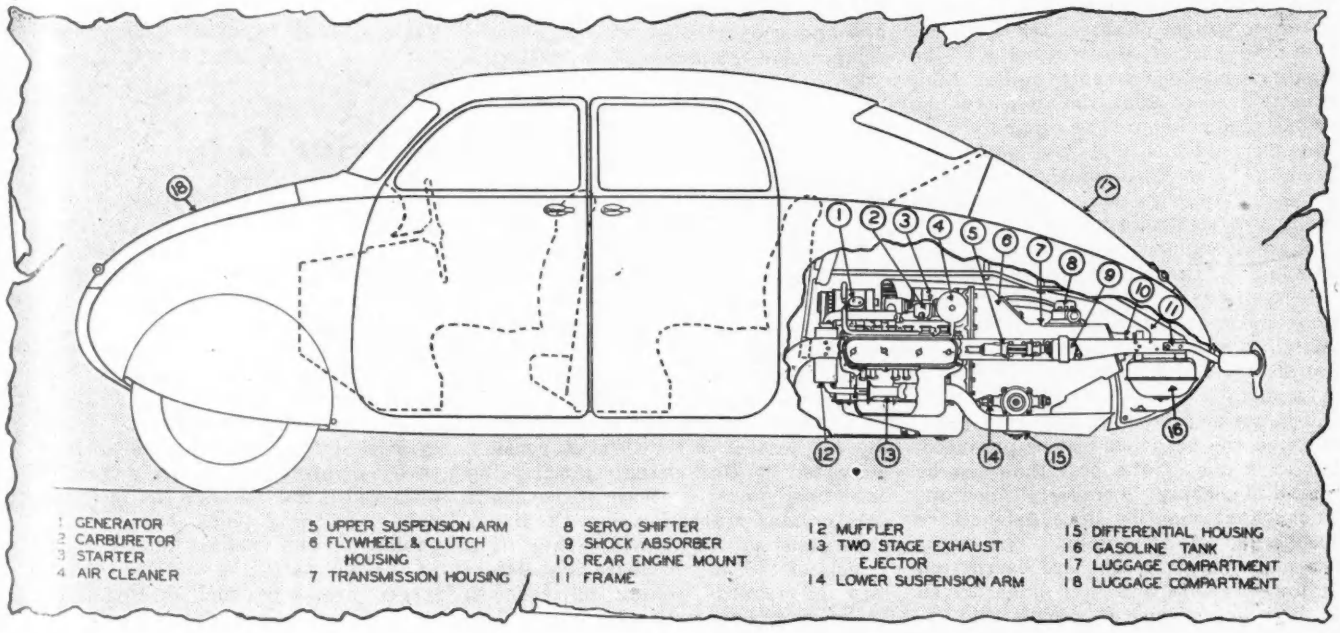
By Carl T. Doman, Vice President and Chief Engineer, Aircooled Motors Corp.

BASED on the results obtained today with modern light aircraft engines, it is possible to put in an automobile a 150 cu in., 6-cylinder opposed-engine which would develop 100 hp at 3800 rpm, the engine proper weighing between 150 to 200 lbs. (A sketch of the proposed automobile and performance curves of the engine are reproduced here.) It could be mounted under the rear floor or on the floor of the trunk, since the vertical height of the proposed type of engine would be a minimum. It would have life between overhauls of at least 50,000 miles, with the very minimum of replacement parts necessary. This design would incorporate aluminum, whereas the water-cooled engines as we have known them have used cast iron.

Noise due to push rods as usually installed on engines with overhead valves could be absolutely eliminated by the use of valves being operated through hydraulic valve lifters manufactured by Wilcox-Rich. These have been successfully used in air-cooled engines in trucks and in airplanes for the past ten years with absolute satisfaction. Another cause of noise—piston slap—can be absolutely eliminated by the modern design of trunk piston.

With the development of metals and better understanding of the science of cooling an engine, it is possible to slow down the cooling air to a point where the noise is not excessive. Further-

This sketch shows a rear-engined car proposed by Aircooled Motors Corp. It has a wheelbase of 116 in., the same body space as a 1942 Ford, weighs slightly over 2000 lb., and is powered by a Franklin 6-A-150 air-cooled engine of pancake design. Fuel mileage is estimated at 30 mpg at 35 to 40 mph. Air for cooling the engine is circulated by an exhaust ejection system instead of by a fan.



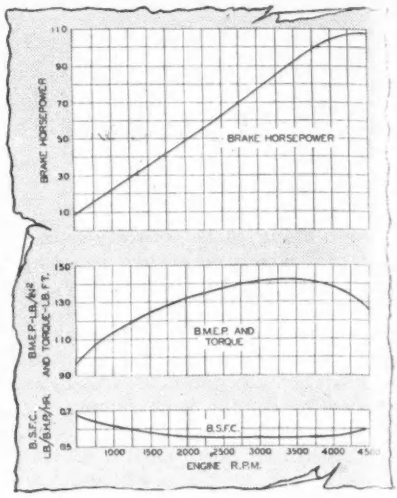
more if the engine is placed in the rear of the automobile, where it no doubt would be in postwar automobiles, any noise would be behind the passengers instead of in front of them, where it would be readily heard.

It is safe to predict that with the fund of knowledge available on the cooling of engines, it would be possible to design an air-cooled engine which could operate on much leaner mixtures than the water-cooled engines. Laboratory tests in the laboratory of Air-cooled Motors Corp. have definitely proved this point. As far as oil consumption is concerned, we have definite figures to prove that a modern high speed air-cooled automobile engine could operate continuously at speeds of 3500 to 4000 rpm, with practically no oil consumption and without any undue wear on the engine parts.

Although the flat type of engine has been mentioned principally here in the discussion, it can be stated without reservation that the same principles of design which apply to a flat engine, could also be applied to an in-line or V-type of engine. The flat engine, however, would seem to work into a rear-engine-automobile much better than the vertical or V-type. Furthermore, the flat engine can be made successfully with 4, 6, 8 or 12 cylinders, or for a low priced car, very successfully in a 2-cylinder type.

When located in the rear it is a very simple task to direct air into the cooling fan from underneath the car, without worrying about the location of the radiator, hoses, etc. In fact, due to the engine's inherent light weight, it could be mounted on the rear axle without interfering with the rotability of the car. The White Horse truck had the engine located in the rear and was bolted directly on the axle and pivoted on a rubber ball. The riding characteristics were surprisingly good; in fact in many of our automobiles there have been examples in recent ones which did not give as good a ride as the White Horse truck.

Summing up the case for the air-cooled power plant for an automobile, it can be said that the engine could be built to incorporate all the advantages of the water-cooled type with none of its disadvantages and produced in quantities at no increased cost over the water-cooled type. The service costs would be certainly less, due to the elimination of all existing cooling difficulties. We do hope that the automobile industry, when it again takes up the problem of selecting an engine for postwar cars, will seriously consider the air-cooled type.



Performance Chart and Specifications of Franklin 6-A-150 Engine

Bore x stroke ..... 3 3/8 in. x 2 13/16 in.
Displacement ..... 151 cu. in.
Compression ratio... 7 to 1
Fuel ..... 73 octane

The Postwar Car

By Roscoe C. Hoffman, Director of Detroit Research Laboratory, Borg Warner Corp.

CERTAIN automobile manufacturers will find that they are unable to get promptly into postwar manufacture of civilian products immediately after the cessation of hostilities because of continuing war contracts, whereas others may be able to get their models into production rather quickly. However, the public may expect that the immediate postwar models will closely resemble the latest prewar models. In view of the probability that postwar taxation will be high, it seems to me that the car of the future will be smaller and considerably lighter than prewar models after the industry has swung from the prewar economic considerations which did not put much premium upon low operating costs. In general these cars will be as roomy as their prewar prototypes.

A rear-engined automobile, in my opinion, is fundamentally sound and can be designed with excellent proportions and with good road visibility, rear visibility, ease of getting in and out, flat floors, and the vehicle low to the ground.

The present type of engine is probably not the best that can be produced, but it is one of the best that can be produced cheaply. There are numerous things that may be done to increase the torque of an engine. We might use superchargers that are overdriven at low engine speeds and underdriven at high engine speeds. With this arrangement considerable increase in torque would result at low engine speeds. I have serious doubts as to whether the public would pay the price for it.

We should get higher efficiency out of higher octane fuels, providing the engine is designed with a much higher compression ratio. Should 100 octane fuels come into general use, the L-head engine will become a thing of the past, as the throat between the valve chamber and the cylinder with a 10 to 1 compression ratio would be so small that the engine could not be run at high speeds. I doubt that a supercharger installed on this design would aid very much.

We will have within a few years automatic transmissions for practically all prices of automobiles, including cars down in $600 to $750 price range.

Air and rubber suspension systems show promise, but their cost is too high at present.

Plastics, bonded wood and aluminum will not compete with steel, except in a few items only such as aluminum may be used in doors, hoods and rear decks of deluxe cars, as the cost of these materials is too high at the moment. There are some possible applications of secondary aluminum.

Too much of the prewar car was designed by stylists, with the results of a sharp trend away from functionalism. The engineering departments of car companies have been forced to leave too much to stylists.

Notes on Light Motor Cars

By Maurice Olley, formerly Executive Engineer, Vauxhall and Rolls-Royce, England.

(1) IT IS possible by study of the size and shape of human beings, and the locations and directions in which they freely bend, to improve the entering and exit of modern cars.

(2) Elementary principles and some dimensional study, supported by experience, show that for adequate stability the softness of a vehicle's suspension, measured by its "virtual static spring deflection," must decrease in considerably greater proportion than the linear dimensions of the vehicle. Thus, if a vehicle of 136 in. wheelbase is satisfactory as regards rolling on corners, brake dive, etc., with a spring deflection of about 8 in., a small vehicle of three-fourths of its principal dimensions, i.e. 102 in. wheelbase, will be completely unstable with a static spring deflection of 6 in., and the suspension will require stiffening up to a deflection between 3½ in. and 4 in. to obtain roadable stability. The decreased static deflection does not necessarily involve a distinctly worse ride, although it does change the feel of the ride. The thing which saves the riding quality of the smaller vehicle is that its "k^2/ab ratio" is higher than the larger prototype, and in the smaller

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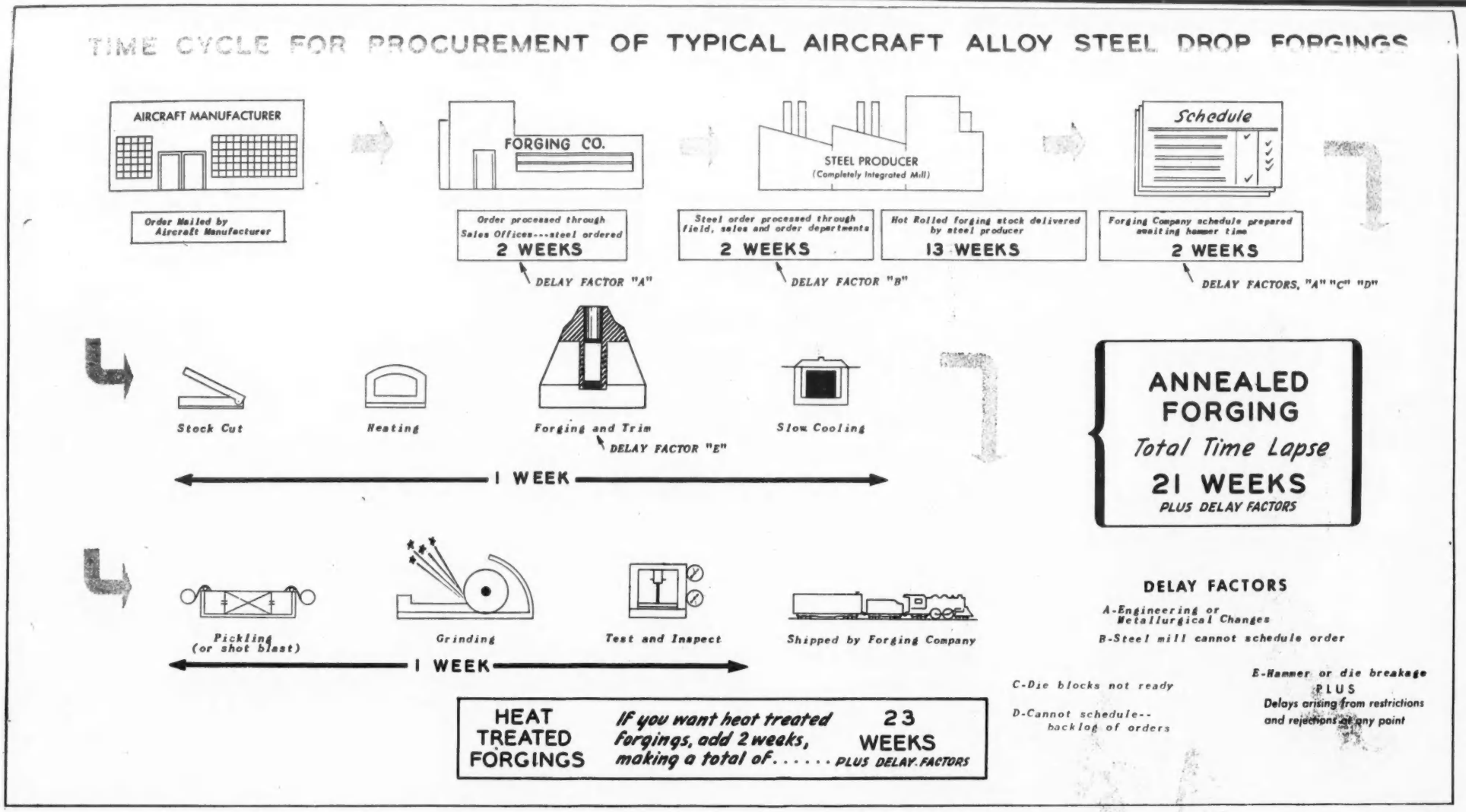


Flow Chart to Facilitate Delivery of Steel Drop Forgings

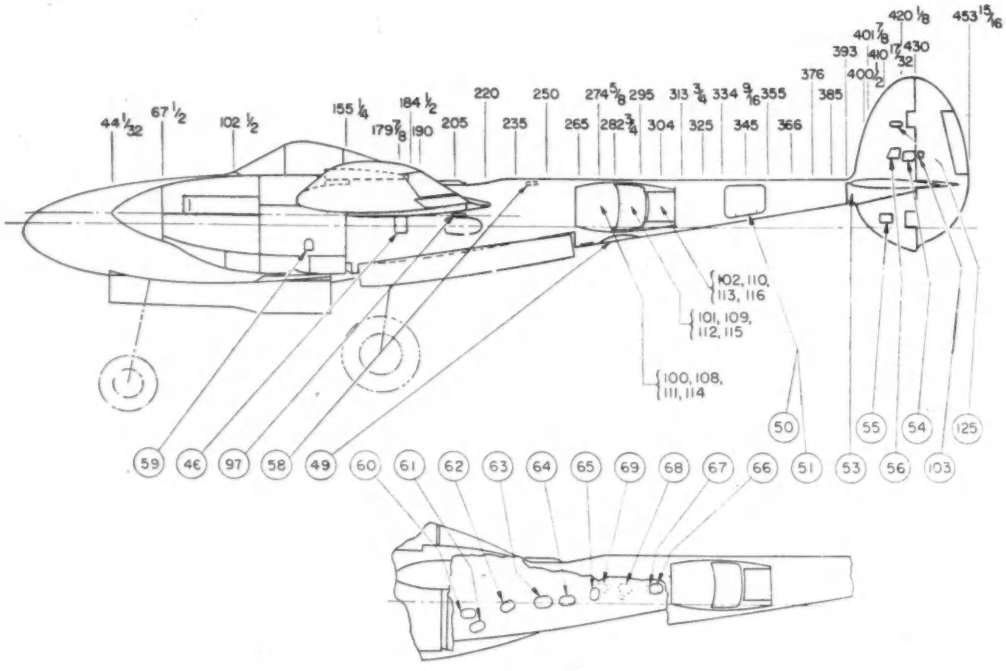
This flow chart, prepared by the Materiel Command of the Army Air Forces at the Wright Field base to offer practical assistance to aircraft manufacturers in ordering typical alloy steel drop forgings, shows an average time cycle for them from the time the order is placed until they are shipped by the forging company. It is pointed out that by allowing maximum time in placing orders for forgings, manufacturers will be able to avoid production stoppages, since the 21-week average for annealed forgings might be stretched to 40 weeks in some cases by delay factors and restrictions at any of several points in the production of the steel and the forgings.

Development

The P-38 in the air for the U. S. Army

THE following summary traces the development of the Lockheed Lightning P-38 fighter from the prototype down through the latest model design, which has been engineered, but not built and exact details of which are restricted for reasons of military security. Drawings also are reproduced here showing the basic construction of the P-38.

XP-38.—The prototype, or basic airplane. Engineering began in the spring of 1937. Delivered in January, 1939. First flight January 27, 1939. Only one built. Powered by two Allison C-15 engines of 1050 hp each. Equipped with so-called "European armament," one Madsen 23 mm cannon and four 50-cal. machine guns. Curtiss Electric automatic controllable propellers of hollow steel, turned in from the top in opposite directions. Wing span, 52 feet. Length of fuselage, 37 ft 9 15/16 in. Height, 9 ft 10¼ in. Two turbo-superchargers.



INBOARD WEB (EXCEPT AS NOTED)

P-38 Boom—Locations of stations and removable panels.

46. Main L.G. Fulcrum Pin (Both Sides Each Boom)
49. Radiator Flap Cylinder
50. Baggage and Tools (L.H. Side Right Boom)
51. Batteries (L.H. Boom Outboard)
53. Empennage Controls
54. Tab Actuating Unit (L.H. Side Each Fin)
55. Elevator Pulleys (L.H. Side Each Fin)
56. Elevator Pulleys
58. Supercharger Oil
59. Starter Extension (R.H. Side Both Nacelles)
60. Coolant Tube
61. Coolant Tube
62. Coolant Tube
63. Coolant Tube and Empennage Surface Controls
64. Tab Cable
65. Coolant Tube and Tab Cable
66. Coolant Tube and Tab Cable
67. Coolant Tube (Outboard Web)
68. Coolant Tube (Outboard Web)
69. Coolant Tube (Outboard Web)
97. Starter Crank Inside (R.H. Outboard Boom Only)
100. Coolant Scoop (L.H. Boom Outboard)
101. Radiator Shroud (L.H. Boom Outboard)
102. Radiator Flap (L.H. Boom Outboard)
103. Tab Actuating Unit
108. Coolant Scoop (L.H. Boom Inboard)
109. Radiator Shroud (L.H. Boom Inboard)
110. Radiator Flap (L.H. Boom Inboard)
111. Coolant Scoop (R.H. Boom Outboard)
112. Radiator Shroud (R.H. Boom Outboard)
113. Radiator Flap (R.H. Boom Outboard)
114. Coolant Scoop (R.H. Boom Inboard)
115. Radiator Shroud (R.H. Boom Inboard)
116. Radiator Flap (R.H. Boom Inboard)
125. Identification Light (Inboard Side of Each Fin)

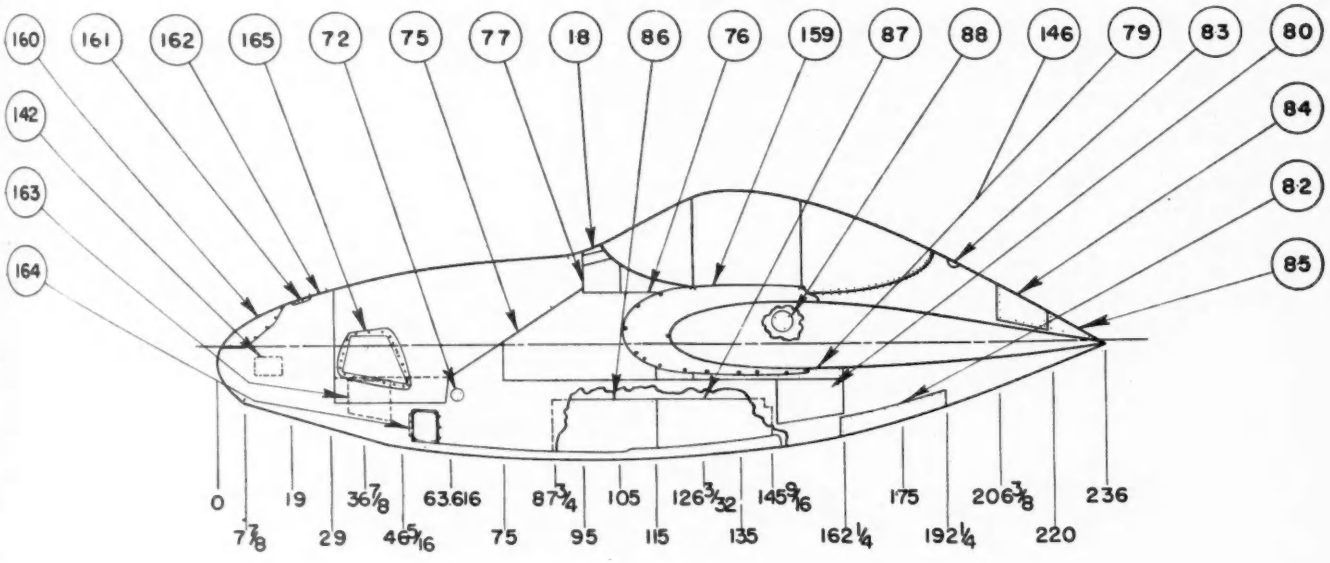
and Engineering Features of Lockheed P-38 Fighter

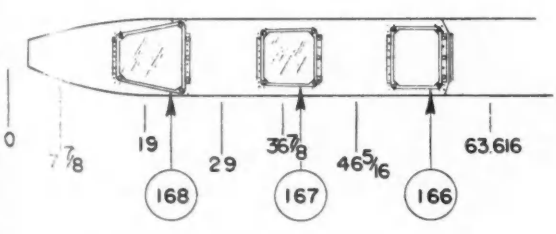
YP-38.—Engineering began in April, 1939; fabrication in August, and in February, 1940, the company started work on assembly of the first plane and static test. Production there was slow, for very little of the experimental tooling used on the XP was usable on the YP. Constant changes in parts necessitated constant changes in tooling. The first YP flew on the early morning of September 18, 1940, and the first delivery to the Army was made in March, 1941, after exhaustive testing of the YP by both Lockheed and Army flight test engineers. Thirteen were built.

The Allison F-2 engine was substituted, having 1150 hp and a higher propeller shaft. The armament compartment was completely redesigned to house one 37 mm cannon, two .50-cal and two .30-cal machine guns. Turbo installation and coolant radiator installation

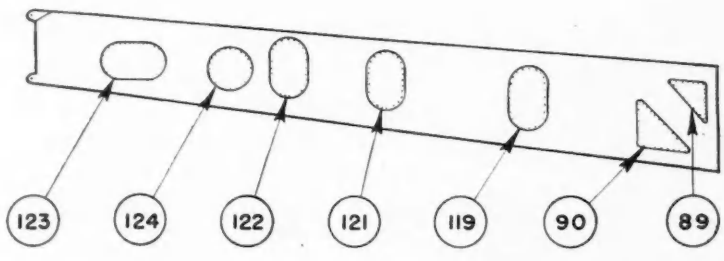
P-38 Fuselage—Location of stations and removable panels.

18. Instruments
72. Nose Landing Gear Fulcrum Pin
75. Plumbing and Electrical
76. Plumbing and Electrical
77. Instruments
79. Window Mechanism (R.H. Only)
80. Control Cables and Plumbing
82. Fuel Sump, Strainers and Valves
83. Hydraulic Reservoir
84. Flap Motor
85. Stirrup (Mounting Ladder)
86. Plumbing and Controls
87. Plumbing and Controls
88. Reserve Fuel Gauge
89. Surface Controls
90. Surface Controls
119. Surface Control Cables
121. Surface Control Cables
122. Surface Control Cables
123. Surface Control Cables
124. Control Pulleys
142. Windshield De-Icer (R.H. Only)
146. Window Mechanism (L.H. Only)
159. Dive Fillet (L.H. & R.H.)
160. 193465 Cover
161. 196112 Cover
162. 196113 Cover
163. 194856 Window (R.H. Only)
164. 194925 Window (L.H. & R.H.)
165. 193477 Window (L.H. Only)
166. 193481-24 Window
167. 193481-23 Window
168. 193481-22 Window





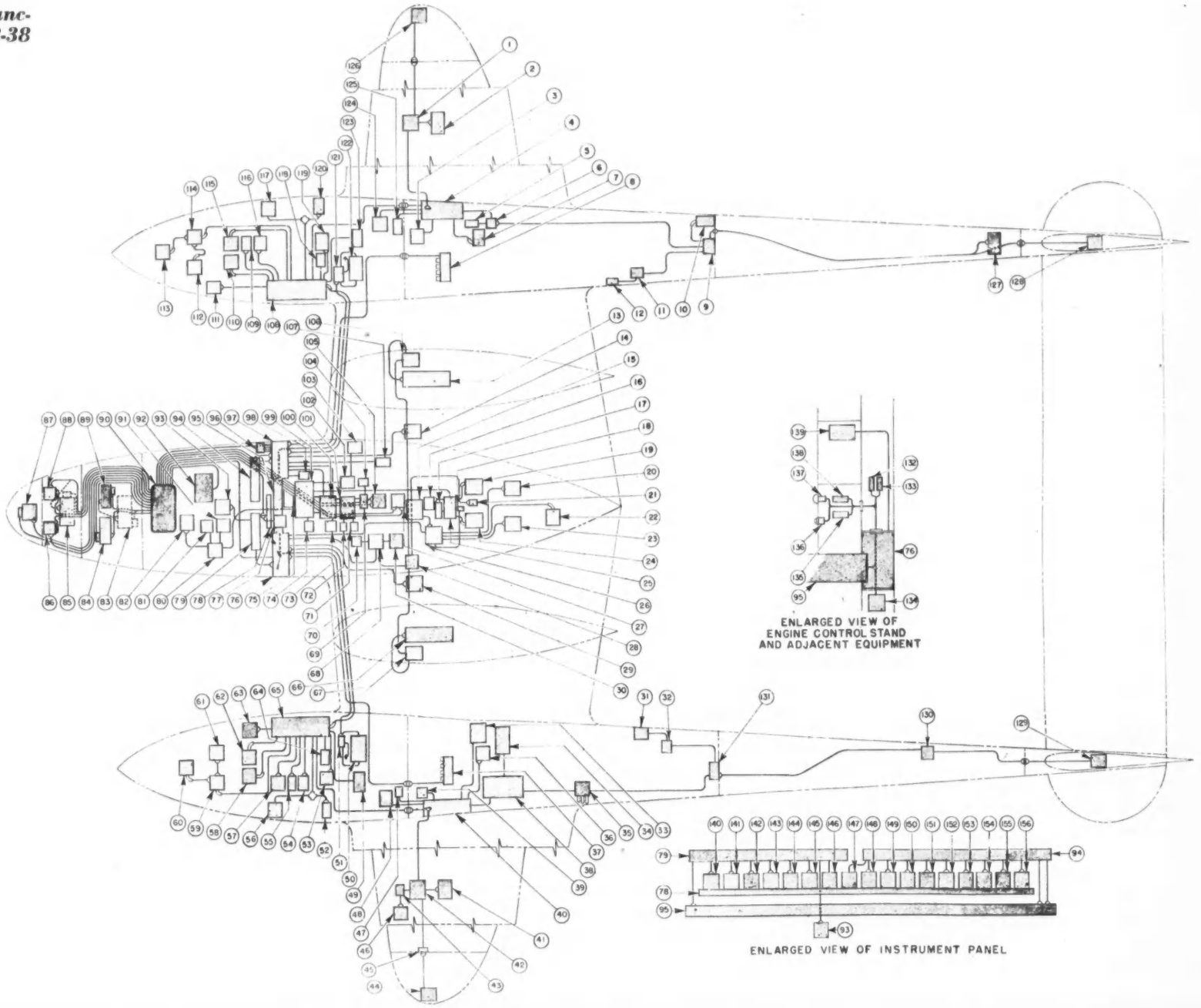
KEELSON WINDOWS - BOTTOM VIEW



MAIN BEAM - CENTER SECTION - LOOKING AFT

Electrical equipment and junction box locations for the P-38 fighter.

1. Landing Light Junction Box
2. Landing Light
3. L.G. Down Position Switch
4. Fillet Junction Box
5. L.G. Up Position Switch
6. L.G. Up Position Switch Junction Box
7. L.G. Position Transmitter
8. Autosyn Transmitter Box
9. Inverter Junction Box
10. Inverter
11. L.G. Up-Lock Junction Box
12. L.G. Up-Lock Switch
13. Bomb or Tank Shackle
14. Front Fuel Tank Transmitter
15. Landing Gear Warning Horn
16. Free Air Temperature Bulb
17. Downward Recognition Lights
18. Upward Recognition Lights
19. R.H. Auxiliary Fuel Pump
20. R.H. Rear Fuel Tank Transmitter
21. Cross Feed Valve
22. Flap Position Transmitter
23. L.H. Rear Fuel Tank Transmitter
24. L.H. Auxiliary Fuel Pump
25. Fuel Pump Junction Box
26. Rear Fuel and Flap Junction Box
27. Reconnaissance Intervalometer
28. Fuselage to Wing Lower Fillet
29. Front Fuel Tank Transmitter
30. Fuel Pump Switch Box
31. L.G. Up-Lock Switch
32. L.G. Up-Lock Switch Junction Box
33. L.G. Scissors Switch
34. L.G. Up Position Switch
35. Battery Cart Plug
36. L.G. Position Transmitter
37. Autosyn Transmitter Box
38. Voltage Regulator Junction Box
39. L.G. Down Position Switch
40. Fillet Junction Box
41. Landing Light
42. Landing Light Junction Box
43. Wing Rib Station 218
44. Wing Tip Light
45. Wing Tip Junction Box
46. Pitot
47. L.G. Throttle Switch
48. L.G. Down Lock Switch



88. R.H. K-17 6" Charting
127. Remote Compass Transmit-

were improved and the props turned in opposite directions, but *out* from the top where in the XP the props had turned *in* from the top. Structural changes, reduction of gages of material and elimination of excess structural parts, in an almost complete redesign of the airplane, resulted in the cut of about 1300 pounds weight.

P-38.—Engineering began in late 1939, deliveries in July, 1941. The .30-cal machine guns were replaced with .50-cal and armor plate to protect the pilot was added.

P-38D.—Engineering began early in 1940, deliveries in August, 1941. A chief feature of the "D" model was the installation for the first time of self-sealing gas tanks. Also, from high pressure oxygen system the plane went to the low pressure system used on all subsequent models. There was a change in the angle of incidence of the horizontal stabilizer, also a redistribution of elevator counter-weights, increasing the mechanical advantage of the elevator control and resulting in elimination of buffeting and facilitating dive recoveries.

P-38 5TH MODEL.—Engineering for a new model began early in 1941, deliveries in November, 1941. The cannon was changed from 37 mm to 20 mm which has been standard in all subsequent models except the camera ships which are unarmed. The armament section and nose landing gear were completely redesigned to accommodate double the amount of ammunition carried in earlier models. On about the 300th of the 5th model, the hollow steep props were replaced by Curtiss Electric constant speed blades made of dural.

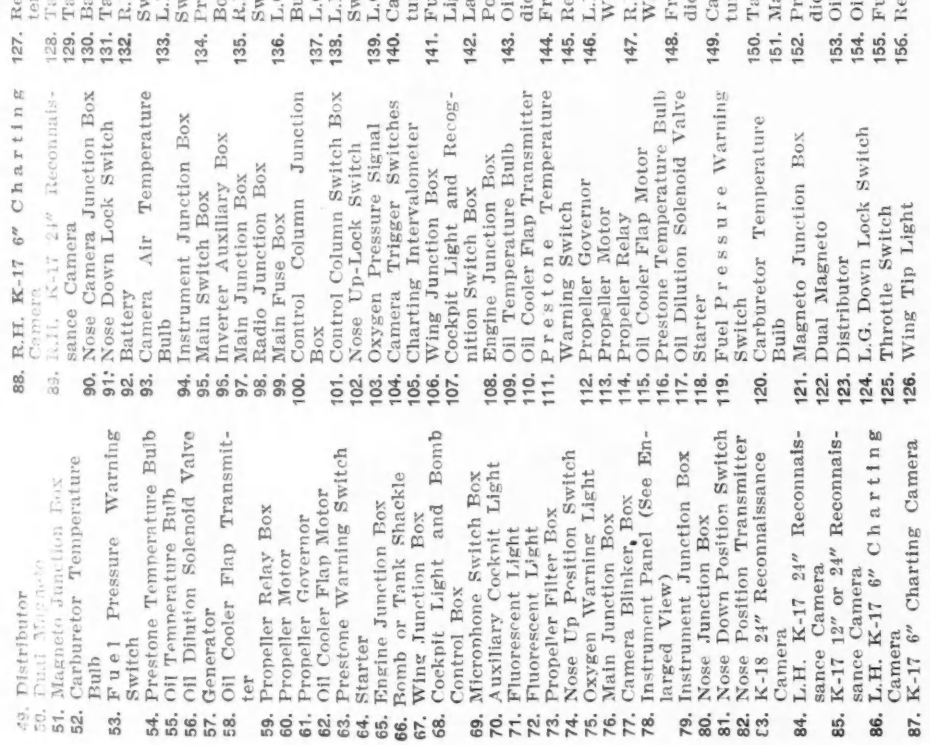
MODEL 322-61.—The "Lightning I" for the British, for which contract was signed in March, 1940. Engineering began about that time, deliveries in December, 1941. The British wanted—and got—no turbo-superchargers, no counter-rotating propellers. Because the higher-powered Allison was restricted, not yet having been released to the British via Lend-Lease, the plane was powered by the old C-15 engine. It had a 20 mm cannon and four .50-cal machine guns, a British radio and British instrument panel. As predicted by Lockheed engineers, the British didn't like the plane without supercharger and with props turning in the same direction, and the 143 Model 322's that were built were sent to a modification center operated by Lockheed and Vega at Dallas, and there changed back into an acceptable U. S. Army model for training.

F-4.—CAMERA SHIP. Engineering began in mid-1941, deliveries in March, 1942. This was a redesigned P-38 equipped with four cameras in the ammunition and gun compartment, and was completely unarmed. It was equipped with a drift-sight to aid the pilot in his photo-reconnaissance work and was given a sky blue camouflage.

P-38 8TH MODEL.—Engineering started early in 1942, deliveries in March, 1942. The power plant was changed from the Allison F-2 to F-5, power from 1150 hp to 1325 hp. This was the first model to come equipped with drop-tank brackets (also used for carrying and releasing bombs from 100 to 1000 lb in weight), one under each inner-wing section. The first "piggyback" fighter (in which the radio behind the pilot was removed to make room for a passenger to ride with the pilot for purposes of instruction) was an 8th Model P-38.

P-38 9TH MODEL—Engineering began in January, 1942, deliveries in June, 1942. Essentially the same airplane as the P-38 8th Model but with a change in electrical instruments and other detail equipment.

P-38 10TH MODEL—Engineering began early in 1942, deliveries in August, 1942. First to use so-called "maneuvering flaps." An engine change to the Allison F-10, same 1325 takeoff hp but up 100 hp



for cruising. Minor changes in electrical equipment and instruments.

MODEL 322-60—The "Lightning II." Engineering began in late 1941, deliveries in August, 1942. Designed under a new contract with the British for a fighter that would include turbo-superchargers and counter-rotation props, this was essentially the same as the P-38 5th Model except for such detail equipment as instruments, radio, etc. But the U. S. Army took over all Lightning I and Lightning II airplanes that were built. The Lightning II was powered by the Allison F-10 engine, the Lightning I by the F-5. Both models were given the Army designation P-322.

F-5—Deliveries began in August, 1942. A camera ship same as the F-4 except that five cameras were carried instead of four.

P-38 13TH MODEL—Deliveries began in May, 1943. Essentially the same as the 10th model except for the substitution of the new Allison F-17 engine with 1425 hp normal, 1600 "war emergency" hp. The same size engine as before but having a faster blower ratio and internal reinforcements.

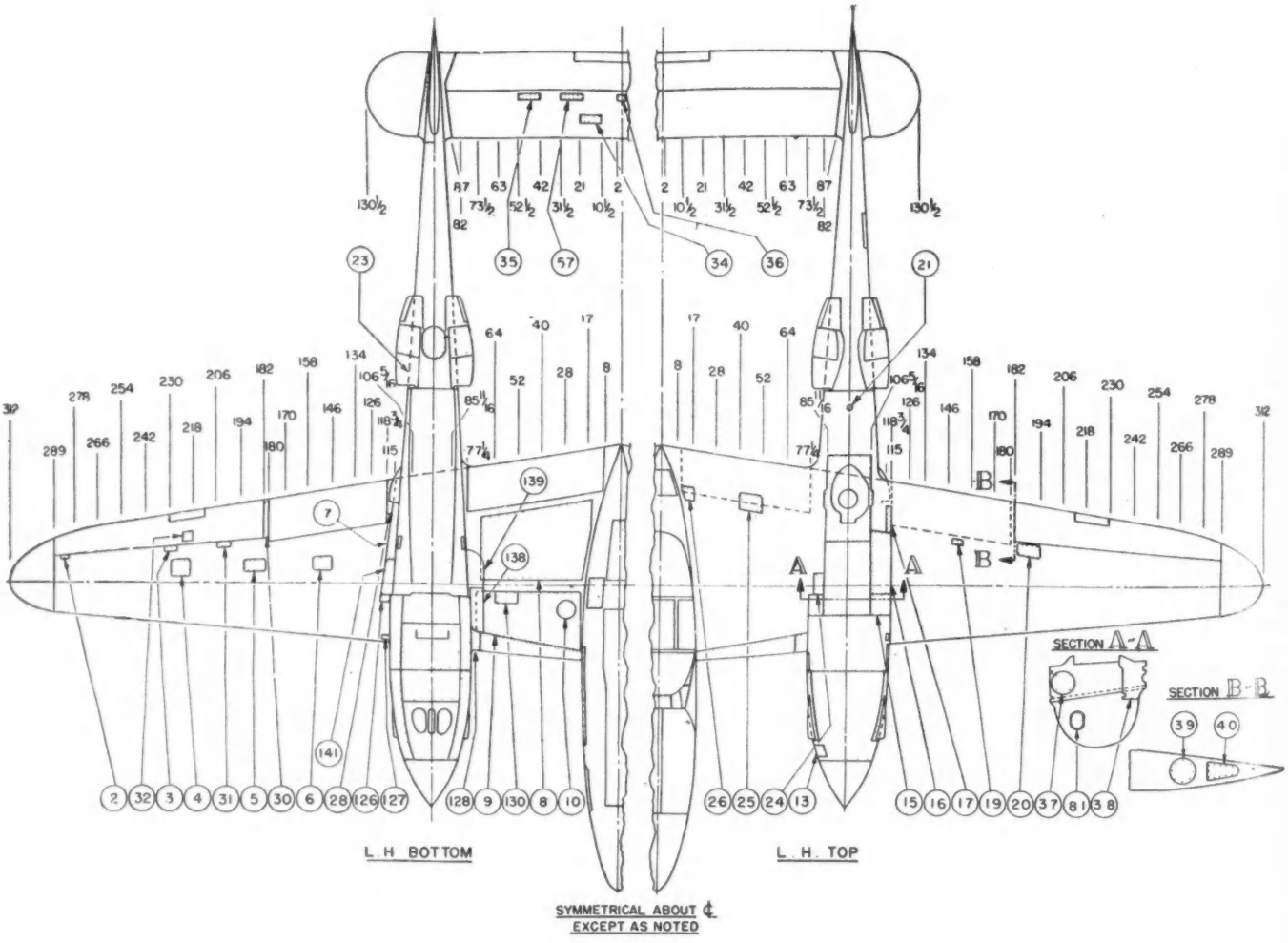
P-38 14TH MODEL—Engineering began in September, 1942, deliveries in August, 1943. The biggest model change since the 5th model. Details are at this time restricted. Will give greatly increased performance, especially in rate of climb at high altitudes.

F-5 CAMERA SHIP 15TH MODEL—Deliveries began in September, 1943. Engine installation same as 14th model. Details restricted.

P-38 16TH MODEL—Engineering began early in 1943. No deliveries yet. Details restricted.

P-38 Wing and Stabilizer—Locations of stations and removable panels.

2. Aileron Counter Weight
3. Aileron Push-Pull Tube
4. Aileron Differential Mechanism
5. Tab Pulley
6. Aileron and Tab Turnbuckle
7. Wing Joint
8. Fuel Tank Inspection
9. Fuel Tank Inspection
10. Fuel Drain
13. Prestone Filler Cap (R.H. Side Both Nacelles)
15. Engine Oil
16. Wing Joint
17. Flap Cables
19. Flap Cables
20. Tab Cables
21. Lift Lug
23. Coolant Tube Joint
24. Lift Lug
25. Flap Cables
26. Flap Cables
28. Flap Cables
30. Flap Cables and Pulleys
31. Tab Idler Pulley
32. Tab Actuating Mechanism Lubrication
34. Rudder Tab Stop
35. Elevator Tab Stop (L.H. Only)
36. Elevator Tab Actuating Mechanism
37. Empennage Control Cables
38. Wing Pins
39. Flap Cables
40. Flap Cables
57. Tab Cable Turnbuckle (L.H. Only)
81. Engine Mount Bay Strut Attachment
126. Intercooler Attachment Bolt
127 Engine Mount Bolt
128. Engine Mount Fitting & Plumbing
130. Engine Control Cables
138. Fairing
139. Fairing
141. Fillet Junction Box



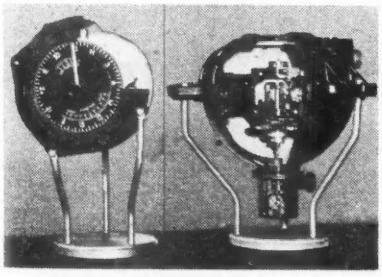
New Products for Aircraft

Bendix Gyro Flux Gate Compass

An entirely new type of compass is in production at the Philadelphia Division of Bendix Aviation Corporation. Developed in the research laboratories of the Eclipse-Pioneer Division of the corporation, the new device is said to be as great an advance over the conventional magnetic compass as that compass was over the lodestone.

This Gyro Flux Gate Compass, as the new compass is known, uses the earth's magnetic field to develop minute electrical impulses which, when amplified, turn the compass indicator.

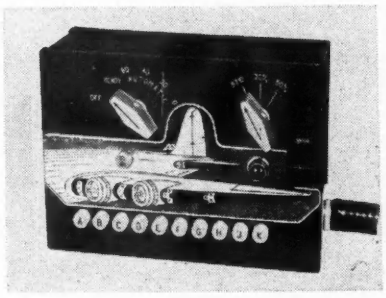
This new compass will not go off its reading when the plane dives or climbs rapidly, it will not lag or overshoot during a turn and it will not oscillate or "hunt" back and forth in rough weather.



Bendix Gyro Flux Gate Compass. At the right is the transmitter, at the left is the indicator.

An advantage of the new compass is that no "correction card," necessary with magnetic types, is needed because it gives fully corrected readings at all times. The possibility of the navigator or pilot making an error in the heat of battle is thus eliminated.

Because it is possible to locate the transmitter of this new compass at a distance from the indicating dial, it is possible to find a position for it where it will not be affected by the bomb-load, armor plate, or other metal parts that impair the accuracy of the standard compass. Additional indicators are linked to the compass through the medium of the Pioneer "magnesyn" system. This system makes possible remote readings of indications or measurements received from a remote source or master.



Eclipse Electronic De-Icer Control

Ice Tire for Airplanes

A new type ice tire for airplanes has just been announced by The Firestone Aircraft Company, Akron, Ohio. Unusual traction is given the tire by large, sharp steel lugs which grip ice and hard packed snow with the firmness of cleats. In addition, the tire is said to perform excellently in soft snow. Its channel tread packs soft snow under the tire to give added flotation as well as superior traction.

The lugs fit into the high-projecting shoulders of wide channel tread tires. They extend from the tread, through the shoulders, to the sides of the tires, where they are bolted in place. A feature of the tire is its adaptability to all-year round usage. This is possible because the lugs used in the tire are removable. By loosening a few bolts, the ice tire can be adapted to use on any regular landing surface.

Electronic Control for De-Icer System

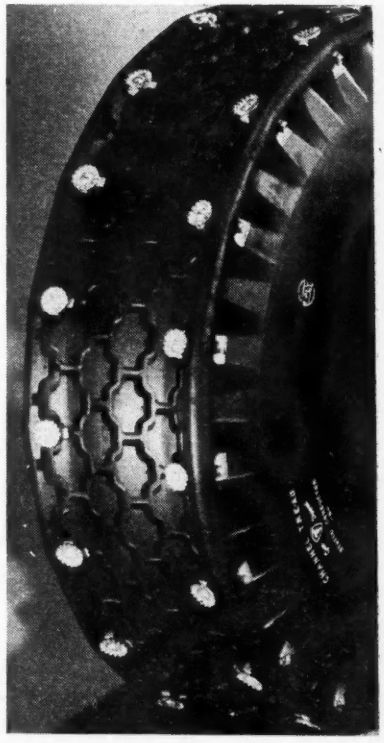
The Eclipse Electronic Control has been developed for use with the Eclipse Manifold-Solenoid De-Icer system in conjunction with B. F. Goodrich De-Icers on aircraft with wing spans in excess of 100 feet to provide a variable control of the De-Icer system to suit the rate of accretion and the texture of ice formations encountered.

Facts established by continuous research and experimentation, substantiated by field experience obtained from mechanical De-Icer performance since its inception, indicate that complete ice removal can be effected by the De-Icer method despite the varying ice conditions encountered, provided the accretion of ice is permitted to develop a tensile strength sufficient to overcome the adhesion between the ice and the De-Icer boot on inflation. This requires that the De-Icer system be controlled for both the rate of accretion and the texture of the ice formation.

The Eclipse Electronic De-Icer Control accomplishes this requisite by providing a means of varying the time between De-Icer operating cycles to compensate for variations in rate of ice formation and, also, varying the De-Icer cell inflation to compensate for variations in texture of ice formations. In addition, it provides a visible automatic or manual push-button remote electrical control of wing and tail De-Icers.

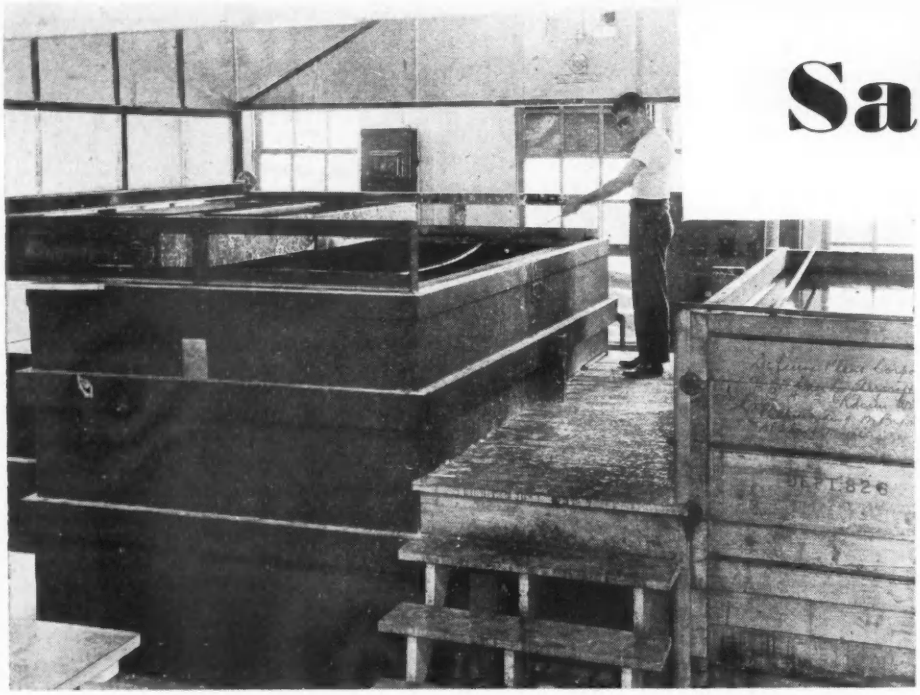
The Eclipse Manifold-Solenoid De-Icer System consisting of electronically controlled solenoid actuated distributor valves located at each De-Icer boot connection; pressure type oil separator

(*Turn to page 62, please*)



Firestone ice tire for airplanes

Salt Bath

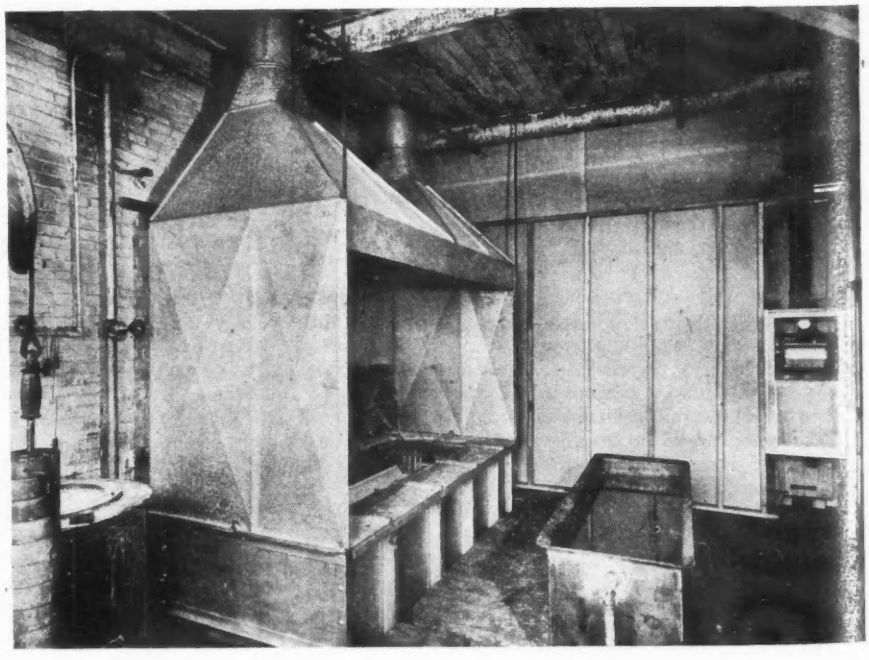


This immersed electrode salt bath furnace built by Vulcan Corp. is being used for heat treating dural and other aluminum alloy parts for aircraft production. It is equipped with an improved refractory lining and the electrodes are widely spaced to prevent overheating and subsequent breakdown of the salt. Air-cooled bus bars eliminate the necessity for water cooling. The rolling cover has ball bearing wheels.

WHEN the neutral salt bath was developed so that it was economical for industrial use, it marked the end of the search of aviation engineers and production men for a suitable means of heat treatment for aircraft parts. It is a well-known fact that carburization or decarburization cannot be tolerated on aircraft parts. Due to this fact it was necessary to machine the parts at hardnesses as high as 50 Rockwell C to remove the contaminated surface. This practice is still being carried on to a great extent, but the advent of the neutral salt bath is gradually doing away with these difficult machining operations.

The applications of the neutral salt bath to aircraft parts are many and varied. It is used for treating both ferrous and nonferrous metals. It is used for copper brazing, assemblies, the salt itself acting as a flux. One of the biggest advantages of the salt bath is that material can be left in it for long periods without danger of surface contamination. Revolutionary treatments are being given to steel in the salt bath, which are making it possible to get more complete transformation of austenite into the desired structure of martensite. These treatments require long heating periods, and in some cases double heating is utilized, having an interrupted quench between heating periods. These latter operations carried on in atmosphere furnaces would probably cause surface contamination to some degree.

Formerly it was always necessary to machine and thread grind all aircraft bolts after heat treatment. It is still necessary to use this method on most of the power plant bolts due to the close tolerances required. However, many of the airframe bolts are now being



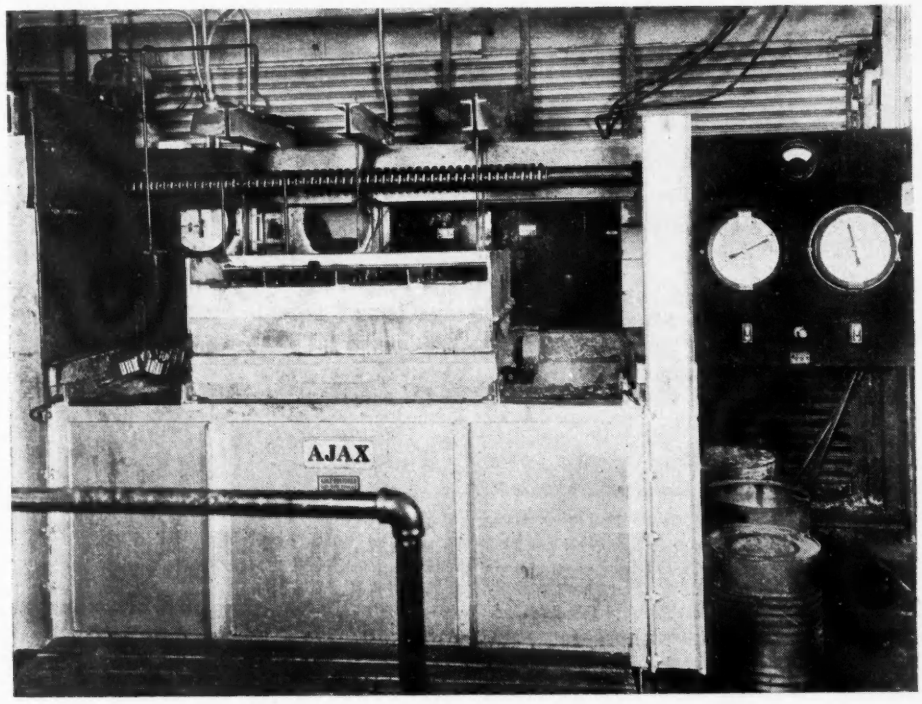
A Vulcan gas-fired salt bath furnace for heat treating ferrous and nonferrous metals in sheets, rods, coils or fabricated shapes. The burners, arranged for maximum efficiency, are installed beneath the pot. This type of furnace is also adapted to oil firing, or electric heating by external resistance heaters, immersion heaters, or immersed electrodes. Temperature uniformity of 3 deg. plus or minus is readily maintained. Quench tanks are conveniently located.

Treatment *of Aircraft Parts*

By Stewart M. DePoy
Metallurgist, Delco Products Division, General Motors Corp.

finished completely on screw machines or are being cold headed and thread rolled. This is made possible because the bolts can be treated in salt baths after finishing. The threads are neither carburized nor decarburized, and the surface is as sound as the interior.

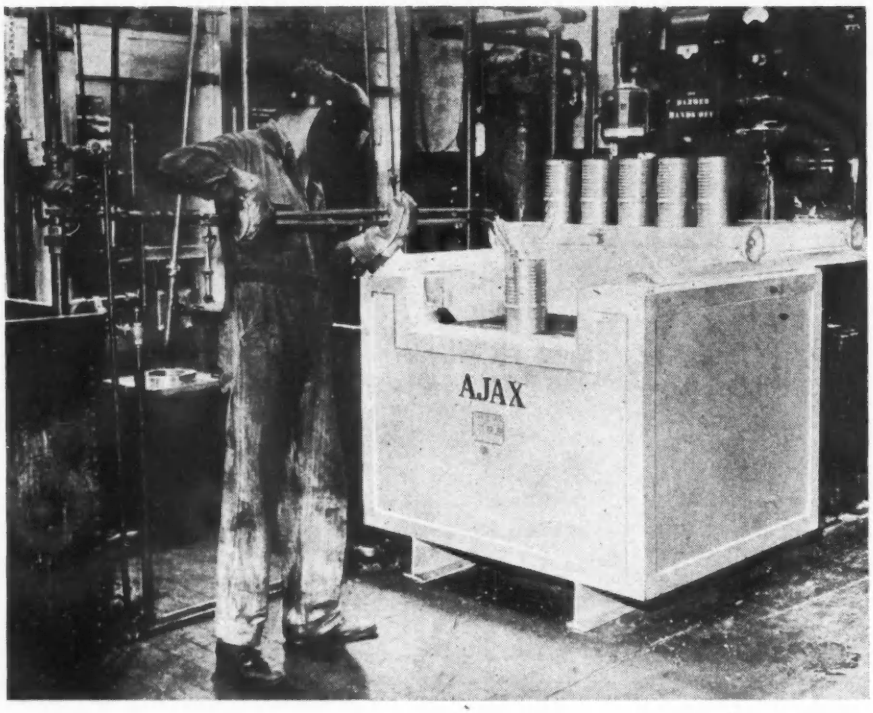
For bolts of 30-40 per cent carbon alloy steels the following treatment has brought good results: Preheat in a salt bath at 1100 F and transfer to another neutral salt bath operating at 1550 F. The soaking time at the high heat will depend entirely on the size of the load, but in no case should it be less than 20 minutes. Quench the bolts in the preheat bath at 1100 F, and transfer again to the 1550 F bath for sufficient soaking time. After this second heating the bolts should be quenched in oil down to at least 200 F. The tempering operation should not be started until the bolts have reached room temperature. The tempering temperature must be determined by the hardness required. However, most airframe bolts are tempered around 900 F. The tempering operation may be done in an air circulating furnace so long as the temperature does not exceed 1050 F. However, a neutral bath is more satisfactory if one is available. The above process may also be used on any steel part that is to be heat treated. Single heating may be used, but double heating tends toward more complete transformation of the solution state to the hardened state.



Cyanide case hardening is done in this fully conveyorized 90-kw Ajax-Hultgren electric salt bath furnace. Alloy steel parts charged at one end are supported by overhead screw on which fixtures are hung. The screw conveys gears and other parts through the bath on a definite time cycle that is automatic throughout, producing case depths up to .030 in. as desired.

As mentioned before, the bath is an excellent medium for copper brazing. Brazing with low melting point metals can also be accomplished in the neutral salt bath, but special atmosphere furnaces have been developed for this low temperature brazing that are probably more satisfactory for quantity production. However, copper brazing can be carried on in the neutral salt bath with splendid results, due to the fact that temperatures of from 1900-2200 F are required for copper brazing. Atmosphere furnaces operated at these temperatures are almost certain to cause surface scaling and contamination. Unless very special atmospheres are used, such as hydrogen, etc., the copper will react with the atmosphere gas and become brittle, thus resulting in a weak joint. Of course, from the standpoint of rapid heating necessary for copper brazing, the liquid bath method is much more satisfactory than any radiant method of heating. Consequently, production can be augmented on large assemblies. (Note: Flux is not necessary in the salt bath brazing.)

Neutral salt baths have been a blessing to the nonferrous industry. Atmospheres have a devitalizing effect on aluminum parts, both cast and wrought. Most aluminum heat treating for aircraft production is now being carried on in neutral salt baths. Artificial aging of the high tensile aluminum alloys is speeded up considerably by heat treatment in the neutral baths. Heat treating problems on other nonferrous metals



A typical neutral hardening operation using a 65-kw Ajax-Hultgren furnace. Immersed in the salt bath at 1550 F and quenched over a mandril in oil the diameters of these large cylinder sleeves are held to a tolerance of .007 in. The output rate is 120 sleeves in 8 hours.

have been very neatly solved by the neutral salt bath. These are too numerous to mention, but you may find a solution to your problem by referring it to any of the numerous chemical and furnace companies which specialize in salts and salt bath furnaces for heat treating.

Success in all the foregoing statements is directly dependent on the correct operation and control of the bath. The oxide content of the bath should never exceed 10 per cent. This is easily checked by determining the insolubles in a sample of the bath. The insolubles are all oxides except when a rectifier is present. The percentage of this rectifier should already be known, and the remaining oxide insolubles can be readily calculated. There are two important methods for reducing the oxides in a neutral bath, e.g., the addition of a rectifier (generally a silicon compound) and the introduction of anhydrous ammonia into the bath. The rectifier forms a "slag" with the oxide compound and sinks to the bottom as a sludge, instead of floating on top as it does in metal melting. This "sludge" *must* be removed once every 24 hours, and in case of continuous operation at working temperatures should be removed every four to six hours. The second method is very effective. It is based on the fact that ammonia will break down into its constituents at this temperature, thus relasing free hydrogen. The hydrogen will immediately react with most of the simple oxides in the bath and carry them out as a gas. *Material should not be treated in the bath while the ammonia is being introduced.* The ammonia should be introduced at an idling temperature, but not lower than 1450 F. At the beginning the gas bubbling out of the bath will burn with a bright yellow flame. When the reaction is complete the flame will subside, and only bubbling will take place on the surface of the bath. The ammonia will not remove 100 per cent of the oxides, but it will serve to "keep" the bath as long as the addition of a rectifier alone will. It is still necessary to add a small amount of rectifier, when using the ammonia method, to sludge down the complex oxides not attacked by the hydrogen. Ordinarily the bath should be completely renewed about every six to eight weeks when in continuous operation. This depends on the operating temperature. The shorter bath life will be obtained on the higher operation temperatures and vice versa. The internal electrode type of furnace is preferred, but gas heated and external electric heated pots may be used. For the internal electrode type a ceramic lining is all that is necessary for a pot. These linings will last 1½ years or more, depending on the intensity of the operating temperature. Considerable care must be taken on this type to keep the electrodes clean. If a heavy scale is allowed to collect and stay on the electrodes above the

(*Turn to page* 156, *Please*)

Recommended Hardening Temperatures and Heating Periods in Salt Baths for Steels

Material	Temperature (Degrees F)	Time Per Inch of Section (Minutes)
SAE 4130 (AMS 6370)	1575	15
SAE 4130 (AMS 6370)	1540	25
SAE 4140 (AMS 6380)	1550	15
SAE 4140 (AMS 6380)	1525	25
SAE 4340 (AMS 6415)	1550	15
SAE 4340 (AMS 6415)	1500	30
Water Hardening Tool Steel	1430	20
Oil Hardening Tool Steel	1460	20
High Carbon-High Chromium Tool Steel	1775	15
High Carbon-High Chromium Tool Steel	1740	30
Tungsten High Speed Steel	2300	3
Tungsten High Speed Steel	2275	4
Tungsten High Speed Steel	2200	5
Molybdenum High Speed Steel	2225	3
Molybdenum High Speed Steel	2200	4
Molybdenum High Speed Steel	2150	5
Cobalt High Speed Steel	2375	3
Cobalt High Speed Steel	2325	5

The above recommendations for *tool steels* are based on a thorough preheat at 1000-1150 F., and a second preheat at 1650 F. in the case of the high speed steels.

New Production Equipment

No. 15 Abrasive Red Band Tool

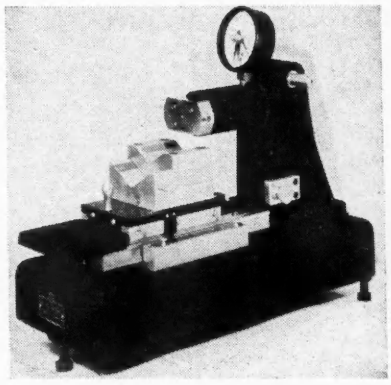
AN exclusive numbering feature, designed to eliminate the danger of careless disposal of diamonds, is a recent development of the Abrasive Dressing Tool Co., Detroit, Mich., manufacturers of Abrasive Red Band diamond tools.

Tool No. 15, typical of the cluster-type series, contains 15 fine, whole, natural diamonds arranged in three layers of five each. The diamonds are precisely spaced and staggered to provide maximum contact with the wheel at all times. Stamped on the head of each tool is a series of figures denoting the number of diamonds in each layer. As the tool is used, the number of diamonds remaining in the tool is indicated through each stage of wear. In this way there is no danger of the tool being discarded before all the daimonds have been completely used up.

THE Air-O-Limit Bearing Gage has been developed by Pratt & Whitney, West Hartford, Conn., to inspect inside diameters for errors in straightness, roundness and size. It was originally developed to check lead-indium plated aircraft engine bearings. This surface is so delicate that high-speed gaging without marring or scratching requires an instrument which does not actually touch the inside diameter. The particular gage illustrated has gaging spindles to inspect diameters from 2 to 5 in., but a smaller model will handle bores as small as ½ in.

Principal components of the gage are the gaging fixture, gaging unit, and the air-supply equipment. The gaging fixture mounts the gaging unit and a ball-supported work carriage that positions the part over the gage plug. Two V-type anvils with T. C. inserts are fastened to the carriage. The one nearest the operator is permanently mounted to receive master ring gages for setting up the instrument, while the other accommodates the work. All master ring gages are of the same external diameter, and the internal diameter is made concentric with the outside diameter to close limits.

The outstanding feature of the comparator is that the product being gaged is not contacted during the gaging operation by any mechanical gage point or gaging plug. The hole being checked will not be scratched or even burnished in any manner no matter how soft the surface is.



Pratt & Whitney Air-O-Limit Gage

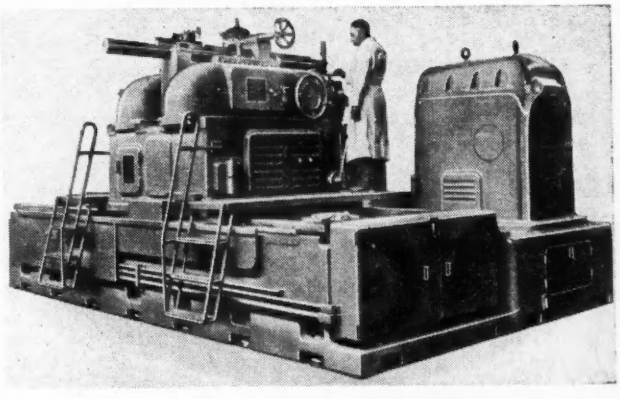
A NEW 75,000-pound Red Ring Gear Shaving Machine has been brought out by National Broach and Machine Company, Detroit, Mich. Gears from 24 in. to 96 in. pitch diameter and up to 97 in. outside diameter are shaved on this machine—the largest of its kind ever built. It has a base 20 ft. by 12 ft. 11 in. and stands nearly 11 ft. above the floor line. Its maximum shaving range from headstock spindle is 110½ in.

Like other Red Ring gear shaving machines, it is designed for rotary crossed axes shaving. The cutter head is equipped with vernier scale and sine bar so that settings to any desired angle within its range can be made readily and any setting can be accurately duplicated thereafter. The cutting tool, which is free to rotate, is driven by the work gear.

Characteristics of the work gear may be accurately checked without removing it from the machine. The checking head, which is an integral part of the machine, is used to determine the size of the work gear, the amount of shaving stock on it, its linear pitch, wobble, eccentricity, and pitch diameter. The operator can check work gear alignment from either side of the machine. The work gear is mounted on journal bearings supported by adjustable pedestals.

Pressure lubrication is used throughout and all lubricant reservoirs are pro-

(*Turn to page* 88, *please*)



Red Ring Gear Shaving Machine

National Metal Congress is

By Joseph Geschelin

NOTWITHSTANDING the vicissitudes of wartime traveling, the National Metal Congress in October at Chicago was one of the most successful held in recent years. This time it was a four-ring circus with technical meetings of the American Society for Metals at the Palmer House, American Welding Society at the Morrison, and the American Institute of Mining and Metallurgical Engineers at the Sherman. Superimposed on this program was the War Conference Display—hotel room version of the usual show—with exhibits located in individual hotel rooms, covering the seventh, eighth, and ninth floors of the Palmer House.

Just as the technical program was developed specifically in the interest of the war activity, so the exhibits sought to emphasize those products and services that were of greatest interest to war time producers. As might be expected there was little of striking innovation or new products shown at the hotel exhibits. Since most producers are straining their efforts at supplying more and more of the needed materials and supplies, they stressed services and new literature available to engineers and metallurgists besides showing the latest developments in their lines.

One of the most striking projects launched at the Congress was the principle of specifying and buying alloy steels on the basis of performance rather than on analysis, which has been developed constructively by Joseph T. Ryerson. This principle is based upon the utility of the Jominy end quench hardenability test, the idea being that the customer would specify his hardenability requirements rather than chemical and physical analysis. Ryerson's Metallurgical Department has carried out an ambitious research program developing a wealth of hardenability data on a variety of most used new NE alloy steels which can be made available to metallurgists in industry.

Corronizing method of rust proofing ferrous and nonferrous metals introduced about six years ago by the Standard Steel Spring Co., has been improved and simplified and reduced in cost of processing. It consists essentially of electroplating a flash of nickel on the base metal then applying another layer of nickel, zinc or nickel, tin. Apart from the improvement in rust resistance and decreased process cost, the latest development is the licensing of fabricators who may be interested in doing their own electroplating of finished products. Under the new scheme any producer having the proper electroplating facilities could do corronizing under a license agreement.

Among the few new items of equipment shown at the display was a line of Gray-Mills all-purpose industrial fluid coolers, portable industrial cooling systems for the filtering and pre-cooling of cutting fluids, for preserving hydraulic oils and quenching oils, and for the chilling of circulating water to the welding tips of spot welders. Another item was the Red-E-Air Chuck, an interesting self-contained air-operated, collet-holding fixture readily attached to all manner of drill presses and other machine tools. It is fast in operation and said to be ideal for such operations as drilling, milling, burring, boring, etc.

Since it would be quite difficult to cover the details of the several hundred exhibits, we shall have to be content with a brief high spotting of some prominent categories of products. Consider first some of the materials producers. In this group were International Nickel, The New Jersey Zinc Co., Aluminum Co. of America, Handy and Harmon with a display of low temperature brazing materials, American Magnesium Co., Rustless Iron and Steel Co., Reynolds Metals Co., The Indium Corp., Molybdenum Corp., Ampco Metal, Inc., specialists in nonferrous sand and centrifugal castings, and others.

That induction heating is fast becoming one of the most useful processes in industry is evidenced by the growing list of companies producing specialized equipment. Among these are The Ohio Crankshaft Co., with a display of the latest types of Tocco hardening equipment; Induction Heating Corp., Budd Induction Heating, Inc., Lepel High Frequency Laboratories, and the new Illitron equipment introduced by the Illinois Tool Works. The Illitron is said to provide a special electrical method for "rematching" in which the generator and load coupling is changed so as to match the generator to the impedence characteristic of the load both before and after the curie point is reached.

Out of the great variety of testing equipment shown here, we have selected some of the more dramatic items such as non-destructive testing of metals and inspection of surface finish. In the latter category are the profilometer developments of the Physicists Research Co., and the brush analyzer. Industrial X-Ray was shown by General Electric X-Ray Corp., and Picker X-Ray Corp. Magnaflux Corp. displayed its line of equipment for the detection of surface flaws, including the latest applications of the Zyglo and Magnaglo equipment for the inspection of non-magnetic materials such as glass, plastics, aluminum and magnesium. The Allen B. DuMont Laboratories, Passaic, N. J., introduced the Cyclograph line of electronic equipment designed to provide non-destructive metallurgical examination of metals in mass production. It is said to provide a 100 per cent check on various characteristics such as case depth, plating thickness, carbon content, variations in heat treatment, etc. The Sperry Flaw Detector was shown by Sperry Products. Inc. Cutting fluids were on display by D. A. Stuart, Cities Service, and E. F. Houghton, the latter also featuring quenching oils and other products.

Among machine tool producers, Andrew C. Campbell showed its line of abrasive cutoff saws, De Sanno and Son, Inc., demonstrated a line of abrasive cutoff equipment, and Doall Midwest Co. displayed its well-known line of tool room and production sawing machines. The S. K. Wellman Co. showed its line of Velvetouch metallic facings for airplane brakes and for clutches. Automatic Transportation Co., Mercury Mfg. Co., Barrett-Cravens Co. and several others displayed lines of industrial trucks.

Abstracts of some of the papers read at the technical meetings of the American Society for Metals and American Welding Society are presented herewith:

Huge Success

An Emergency Heat Resistant Alloy

by Oscar E. Harder and James T. Gow, Battelle Memorial Institute

IN AN attempt to develop heat resistant alloys, low in scarce metals, for service up to 1400 F, nearly 100 alloy compositions were studied. The work included melting, casting, bend tests and tension tests at room temperature, tension and creep tests up to 1600 F, and determination of the resistance of alloys to scaling in air and sulphur-bearing gases at temperatures of 1400 and 1600 F. The most promising results were found with an alloy containing carbon 0.35 per cent, chromium 12.3 per cent, silicon 2.28 per cent, nickel 7.8 per cent, and manganese 7.8 per cent. This alloy was considered to have adequate strength, ductility, load-carrying capacity and resistance to oxidation at 1400 F and was wholly austenitic. Some comparisons are made between the properties of the emergency alloy and those of 18 per cent chromium—8 per cent nickel and 25 per cent chromium—12 per cent nickel.

Stored Energy Welding of Mild Steel

by J. M. Diebold, Yellow Truck & Coach Mfg. Co.

A STORED energy welder was purchased by the company for the express purpose of studying its welding characteristics on copper, stainless steel, and mild steel as well as aluminum.

The studies on mild steel weer especially interesting because of uniformity and minimum indentation found when using the stored energy machine. Results of this study showed that the welding range of mild steel falls into four definite zones which are controlled by weld bead growth. Welding in the third zone proved to be the most reliable and best for production work from the standpoint of metal finishing, tip life, and omission of flashing, spitting and extruding while welding. Quality of the welds made on a stored energy machine is very uniform; and while slower than AC equipment, this machine is considered competitive because of the greater uniformity and fast weld time which localizes heat. This advantage is applicable to the lighter metal gages only of 1/16 in. thickness or less. Heavier gages can be welded, but require much higher heat settings and have the usual heavy indentation of the spot weld. The upper limit of the machine was 10 gage mild steel.

The Microhardness Tester as a Metallurgical Tool

by Constance B. Brodie, Research Laboratory, General Electric Co.

THE microhardness tester has been developed as a useful metallurgical tool. The procedure for using the instrument and its application are described in the paper. Thus far the instrument has been used successfully in the study of the following: welds, small wires 0.20 mm dia, thin strips having a thickness of a few hundredths of a millimeter, surface layers of carburized or nitrided type, tool steels and tips of cutting tools, extremely soft materials such as lead, and extremely hard or brittle materials such as diamonds, carbides, glass, and silicon.

A table comparing the Knoop hardness with Rockwell and diamond pyramid hardness is given here for various materials. The Knoop hardness is very nearly the same as the diamond pyramid hardness. A similar correlation showed that Brinell hardness was only slightly lower, approximately 25 points.

Fatigue Strength of Welded Aircraft Joints

by T. V. Buckwalter and O. J. Horger, The Timken Roller Bearing Co.

FATIGUE tests were made on welded triangular structures and copper and silver brazed sleeve joints which were made from aircraft tubing. Oxy-acetylene pressure welded joints of 2-in. diameter were also investigated in rotating bending. A total of eight triangles were tested and the results show that there are no outstanding differences in the fatigue resistance of the triangles for the various conditions

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Comparison of Knoop, Rockwell and Diamond Hardness

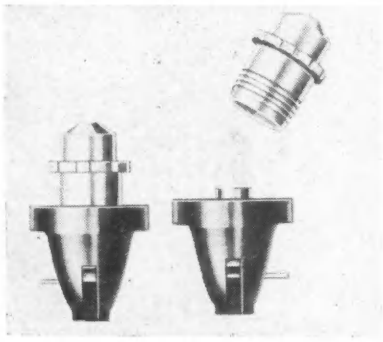
Material	Condition	Knoop Hardness Number	Rockwell Hardness	Diamond Pyramid Hardness 25Kg Load
1.1 C Steel	1 hr. 775 °C., W.Q. 1 hr. 150 °C., A.C.	700–800	R_c 65	843
0.40 C Steel	1 hr. 800 °C., W.Q. 1 hr. 150 °C., A.C.	600–700	R_c 55	690
1.1 C Steel	1 hr. 775 °C., W.Q. 1 hr. 350 °C., A.C.	550–580	R_c 50	580
1.1 C Steel	1 hr. 775 °C., W.Q. 1 hr. 450 °C., A.C.	400–500	R_c 42	455
Beryllium Copper, 2.25% Be	2 hrs. 850 °C., W.Q. 16 hrs. 300 °C., A.C.	406	R_c 42	400
1.1 C Steel	1 hr. 775 °C., W.Q. 1 hr. 550 °C., A.C.	300–400	R_c 35	360
1.1 C Steel	1 hr. 850 °C., F.C.	280	R_b 95	240
0.20 C Steel	Cold rolled	260	R_b 95	240
1.1 C Steel	1 hr. 775 °C., W.Q. 1 hr. 650 °C., A.C.	225	R_b 92	210
0.40 C Steel	1 hr. 800 °C., A.C.	194	R_b 87	205
0.20 C Steel	1 hr. 850 °C., F.C.	188	R_b 83	185
Beryllium Copper, 2.25% Be	Solution quenched and cold worked	175	R_b 81	180
65:35 Brass	Cold drawn	145	R_b 76	140
Commercial Nickel	Annealed	125	R_b 60	125
Dural 17 ST	Hardened	120	R_b 65	125
OFHC Copper	Cold drawn	118	R_b 45	100
Electrolytic Iron	Annealed	100–120	R_b 95	92
65:35 Brass	Annealed	80	R_b 34	80
OFHC Copper	Annealed, 1 hr. 400 °C.	52	R_b 76	50
Fine Silver	Annealed, 1 hr. 425 °C.	51	R_b 55	33
Aluminum—2S	Cold Worked	35	R_b 57	30
Horse Head Special Zinc	As cast	34	R_b 45	28
Aluminum—2S	Annealed, 1 hr. 400 °C.	24	....	19
Alton Lead	Annealed	5	....	..

New Products

Molded Plastic Indicator Lamp

A small molded plastic indicator lamp is being offered by the General Electric Company, Schenectady, N. Y. Special feature is a lock-on color cap which cannot be shaken loose and will not "freeze" to the base. As many as five circuits can be identified on one panel by the use of five different color caps—amber, red, green, white and blue.

The lamp is supplied ready for



GE indicator lamp

mounting. The base is mounted directly to the back of the instrument panel and the color cap is screwed into the base through the panel. A coil spring applies constant pressure to the base of the lamp bulb to maintain a good electrical contact. The lamp takes 6- to 8-volt bulbs.

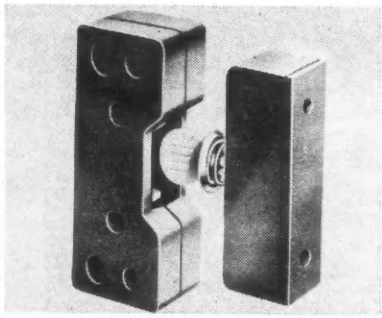
Applications include radio transmitters, and any other equipment or control device where a glow lamp is needed to show that the device or circuit is on or off.

Door Interlock Switch Designed

A new door interlock switch, designed as an emergency device to interrupt control circuits where access doors are opened when the power is on, has been introduced by the General Electric Company, Schenectady, N. Y.

It has a carrying capacity of 10 amp, 110 or 220 volts a-c or d-c, and an emergency opening capacity of a-c 7½ amp, 110 or 220 volts; d-c on low inductive circuits, 5 amp, 125 volts; 2½ amp. 250 volts.

Application covers a wide range where doors, windows or covers must



GE door interlock switch

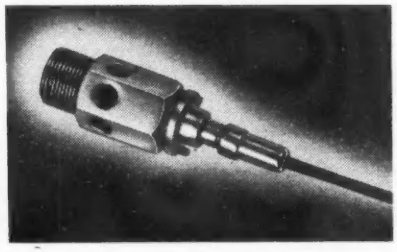
be interlocked for the protection of the equipment and safety of the personnel. For example, doors on radio transmitters, X-ray machines, burglar alarms, and signal controls for fire doors.

Pickups with Bayonet Type Socket

Electro Products Laboratories, Chicago, Ill., is now in production on the new improved Pick-Up No. 3000B. This latest development has a new bayonet type socket which provides quick, reliable contact between connection cable and pick-up. Adaptor adjustments are simpler because of the use of two setscrews which replace the older type hexagonal nut. This construction permits installation and removal from the engine with an ordinary socket wrench.

The pick-up coil has special impregnation that withstands continuous operating temperatures of 350 deg. It is engineered to provide quick replacement of either diaphragm or coil for extra economical operation and long life. Operates at constant polarity.

The Electro Pick-up is designed for use in studies of detonation conditions in internal combustion engines, and for compression conditions in pumps and other devices where there are variations in pressure. It also may be used to actuate a cathode ray oscillograph or the Electro Knock-Intensity Indicator for rating of engine fuels.

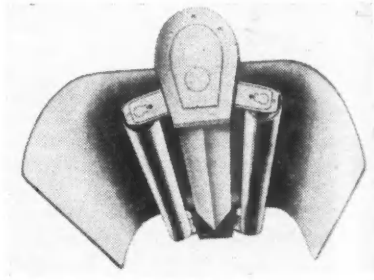


Electro Pick-Up No. 3000B

Fluorescent Light Unit

The Model MF-240-N instantaneous starting fluorescent lighting unit which has just been brought out by The Fostoria Pressed Steel Corporation, Fostoria, Ohio, eliminates the use of starting switches. It provides average lumen output, low voltage operation and satisfactory lamp life. Elimination of starting switches cuts down maintenance costs resulting from replacement; it also means that there is no blinking of lamps when their life is near end. Instead, the lamps will operate without blinking for the satisfactory number of hours and then fail instantly.

The lumen output for MF-240-N is approximately the same as any other



Model MF-240-N lighting unit

two-lamp 40 watt unit powered by conventional ballast, which is 4200 lumens when using 3500 deg. white lamps.

Low voltage operation is important where there is a fluctuation in line voltage. This unit will continue to operate even though the voltage drops momentarily below 50. Lamp life with this unit is said to be satisfactory, even though lamp manufacturers say that a reduction of as much as 50 per cent may be expected. Elimination of starting switch costs help balance any decrease in lamp life which may be experienced.

MF-240-N operates on a power factor of 98 per cent at 118 volts and is connected for stroboscopic effects. It is designed to accommodate two 40 watt fluorescent lamps mounted to 5 inch

(*Turn to page* 84, *please*)

LIFTING A YOUNG INDUSTRY OUT OF OLD HAZARDS

TESTED "IN ACTION" ON THE GROUND

for safer action in the air!

Not so long ago the only dependable way to check the operation of many parts of an airplane was to test them in action. And if tests had to be made in actual flight at the risk of a pilot's neck—well, in those days, what were test pilots for, anyway?

But HydrOILics has changed that.

For example, the gasoline-powered HydrOILic Test Stand shown at right checks the whole hydraulic system of an airplane in a few short minutes—*while the plane is safe on solid ground.* It's a mighty important test because ailerons, rudders, brakes, bomb bay doors, landing gear, and even the propeller pitch of modern planes depend on the hydraulic system for safe, smooth, accurate operation.

Other HydrOILic Test Stands check other phases of airplane performance on the ground, for safety in the air.

Aircraft Testing Equipment is merely one of many ways in which Denison HydrOILic engineers have applied the numerous advantages of *oil-hydraulic operation.* The smooth, flexible, accuracy of HydrOILic's oil-transmitted POWER, SPEED and CONTROL has been adapted to an impressive range of operations in almost every industry. Have *you* sounded out the new possibilities for improving your product, or its production, with Denison HydrOILic engineering or equipment? For information, call your Denison representative, or write to Denison engineers.

The **DENISON ENGINEERING CO.**
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INDUSTRY'S NEW RIGHT HAND

Continental Aviation to Make Rolls-Royce Merlin Engines

Aluminum Forging Output and Capacity Expanded; Westinghouse Takes Over Naval Ordnance Arsenal

Another manufacturing source for the Rolls-Royce Merlin liquid-cooled aircraft engine has been authorized by the Army Air Forces with announcement that Continental Aviation & Engineering Corp. will produce these power plants on a quantity basis at its new Muskegon plant. At present Packard Motor Car Co. is the only U. S. manufacturer of these engines, which power the P-51-B Mustang, the P-40-F Warhawk and such British planes as the Spitfire and Mosquito and Lancaster bombers. Originally Packard built the Rolls-Royce engine with a single-speed, single-stage supercharger, but in recent months the two-speed, two-stage type, which develops more than 1,500 hp. and improves the altitude performance, has been allotted an increasingly larger proportion of the production. Packard has been producing Rolls-Royce engines since August, 1941.

Award of the Rolls-Royce contract to Continental Aviation & Engineering Corp. will involve a reallocation of the war work of that company and its parent, Continental Motors Corp. Production of the Pratt & Whitney R-1340 engine, a 9-cylinder, 650-hp. engine used to power airships and advanced trainers, will be transferred from the new Muskegon plant to Garland, Tex., near Dallas. This engine has been in production at Muskegon since April. The Muskegon plant should be well equipped to manufacture a liquid-cooled engine like the Rolls-Royce because it originally was planned to make the Continental IV 12-cylinder in-line engine there. The latter liquid-cooled engine is being flight tested by the AAF and has been built at Muskegon on an experimental basis. The Garland, Tex., plant, originally built by Guiberson Diesel Engine Co. for the manufacture of diesel tank engines, has been operated by Continental Motors Corp. since September, 1942. This plant manufactured parts and sub-assemblies for the Continental plant at Detroit, which is the largest producer of tank engines in the U. S. The Texas plant output will be concentrated in Detroit, where Wright Cyclone 9-cylinder tank engines are built for medium tanks.

Management of the $28,000,000 Naval Ordnance Arsenal at Center Line, Mich., on the outskirts of Detroit, built and operated since 1941 by Hudson Motor Car Co., has been taken over by Westinghouse Electric & Mfg. Co., effective Oct. 28. In announcing the change in management, Rear Admiral W. H. P. Blandy, chief of the Navy's Bureau of Ordnance, said:

"The Navy Dept. has determined that it is to the best interest of the government to change the operating management of the naval ordnance plant in Center Line, Mich. This change . . . is being made to consolidate the activities of the Center Line plant with those of affiliated naval ordnance plants at Canton, Ohio, and Louisville. All three of these plants are adjuncts of the Naval Gun Factory at Washington. . . . During the period of transition, it will be necessary to assign a limited number of specially trained Naval Gun Factory personnel to the plant."

A. E. Barit, Hudson president, made the following statement, after conferring with Navy officials in Washington, "Hudson's undertaking with the Navy has covered a period of three years. . . . We are indeed glad that we were able to make this contribution to the war effort. This was one of several undertakings for the Army, Navy and Air Forces; the balance are now in production in our own plants, which have been completely converted."

Construction of the Naval Ordnance Arsenal began March 17, 1941, and it was formally dedicated Oct. 28, 1941, by Secretary of the Navy Frank Knox. It is located on a 135-acre site and comprises 14 buildings. It manufac-

(*Turn to page* 56, *please*)

Management-Labor Committee Tackles Detroit Job Problem

UAW-CIO Takes Stand Against Incentive Pay Plans; Unauthorized Strikes Continue Despite Pledges

Solution of the manpower crisis in the Detroit area on a community basis, as recommended in the Baruch report, has been accepted by the War Manpower Commission and labor-industry cooperation will be relied upon to make effective the minimum standards for employment stabilization plans laid down by WMC. A joint labor-management committee will undertake to establish a production urgency system that will channel workers to jobs on the basis of relative emergency, halt labor turnover through stabilization and acquaint Detroit with the immensity of the task it faces in providing a probable additional 82,000 workers by next Jan. 1 to meet the production schedules in the city's plants. This group will determine the way in which workers will be guided to the most urgent jobs, as is being done in other areas, where hiring of employes in 149 critical occupations and in-migrant workers is controlled by the U. S. Employment Service. Such a plan of controlled referral was first tried in Buffalo with male workers only, then later applied to all workers on the Pacific Coast and in Louisville; Hartford, Conn.; Akron and Monroe, Mich., the latter only 40 miles south of Detroit.

Detroit industry took the initiative in this plan by recommending a "Drive for Victory" on a community-wide basis which would accept responsibility for helping solve such manpower problems as turnover and absenteeism, child care, juvenile delinquency, shopping and rationing difficulties, housing and transportation problems. Labor leaders were attracted to the plan when it was pointed out that some war contracts might be removed from Detroit if the manpower situation was not alleviated. They also were opposed to certain restrictions on individual freedom in seeking employment.

The WPB already has set up a Production Urgency Committee in Detroit which will determine the relative importance of war production contracts and essential civilian services and guide needed workers to those which are most urgent. It will attempt to obtain some balance between labor demand and supply through more realistic appraisal of contract manpower needs. D. J. Hutch-

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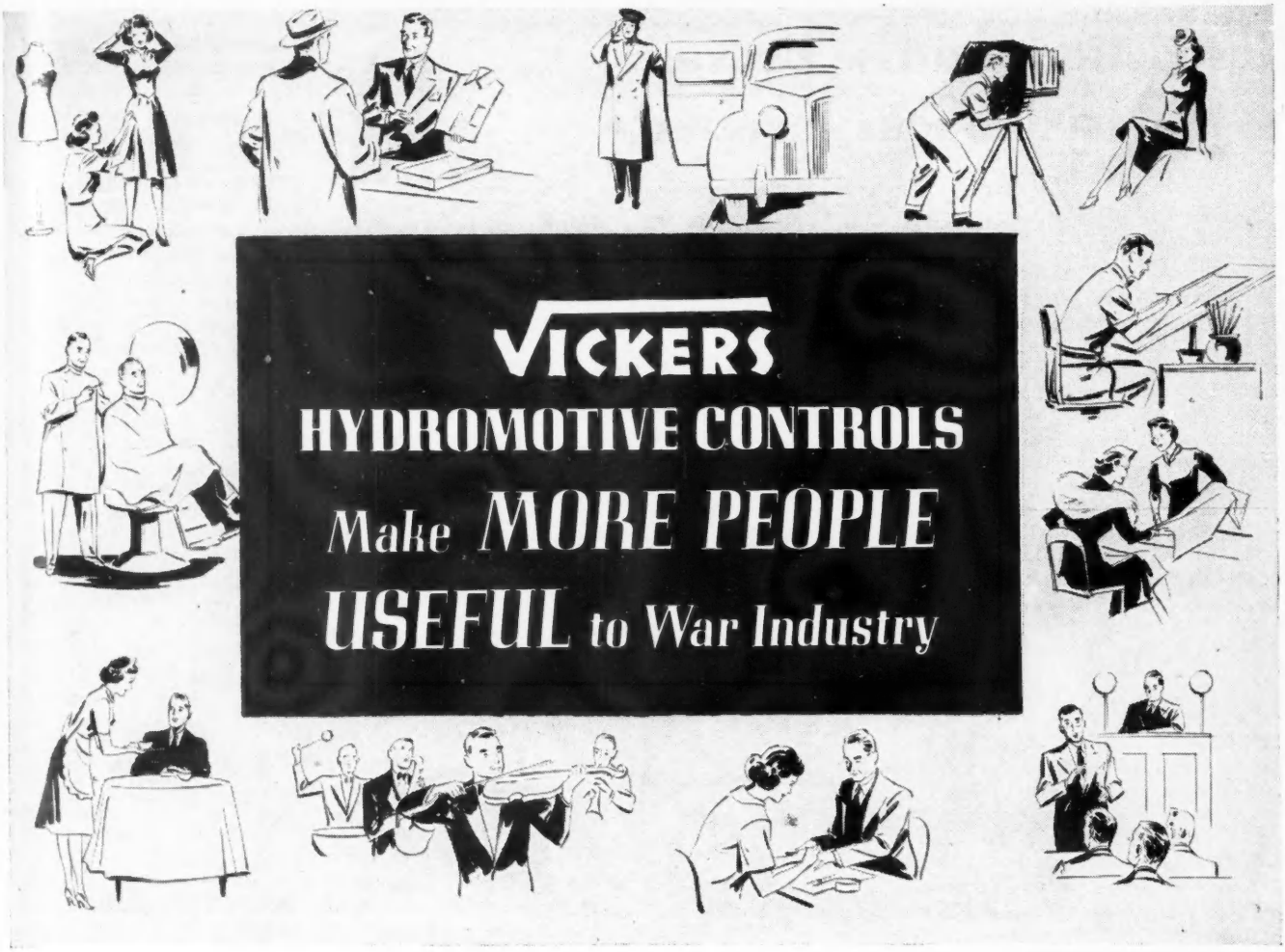

VICKERS HYDROMOTIVE CONTROLS Make MORE PEOPLE USEFUL to War Industry

Lawyers—manicurists—barbers—waiters—salesmen—housewives—all sorts of people must be used by industry to meet the critical manpower shortage. These people are usually entirely unfamiliar with machines and shops. Before they are useful in production, their sense of strangeness and their lack of self confidence must be overcome . . . and they must be taught to run a machine.

A complex machine makes the training task extremely difficult. It is much easier with machines equipped with Vickers Hydromotive Controls.

When one of these people is shown a Vickers controlled machine—shown how simple the controls are—how easy it is to produce good work, his strangeness and lack of self confidence are quickly overcome. It becomes much easier to train him to useful production needs.

With Vickers Hydromotive Controls, most of the required skill can be built into the machine. Complex operations can be reduced to simple routines or made automatic. Controls can be interlocked so it is impossible to do the job wrong. Exact load limitations are easily applied.

Discuss "hydraulics" for your machines with a Vickers Application Engineer.

VICKERS *Incorporated* • **1428 OAKMAN BLVD.** • **DETROIT 32, MICHIGAN**

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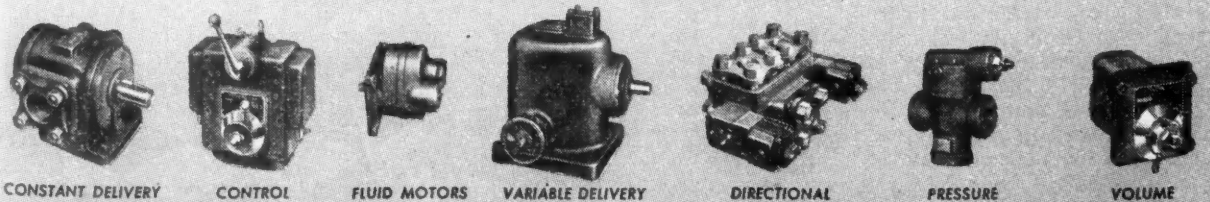


CONSTANT DELIVERY PUMPS | CONTROL ASSEMBLIES | FLUID MOTORS | VARIABLE DELIVERY PUMPS | DIRECTIONAL CONTROLS | PRESSURE CONTROLS | VOLUME CONTROLS

Restrictions on Use Prevail As Material Stocks Increase

Easing of Pressure on Plate Rolling Capacity Expected as New Mills Get into Production

By W. C. Hirsch

With the possible exception of alloy tubing for the aviation industry, relatively little delay in the movement of steel products to war plants is experienced. Producers' order books for the first half of 1944 are rapidly filling up, especially so on heavy hot rolled sheets, but it is generally recognized that at least part of this business must be looked upon as tentative, subject, as the need for much of this material is bound to be, to whatever alterations take place in the various war theaters. The immediate pressure on plate-rolling capacity, which affects other descriptions of flat rolled steel, is expected to be relieved to some extent when additional mills, now nearing completion, go into production early next year. Under CMP procedure, mills are allowed to book up to 110 per cent of the tonnage of each product they are directed by WPB to turn out in a given month. The base tonnage amounts to 95 per cent of actual mill capacity, so that 110 per cent permissible bookings represent around 105 per cent, and of this a certain amount is expected to be leveled off by cancellation, the remainder being about on a par with actual capacity. That there is little question that sheet mills are operating at this time at capacity, may be seen from the fact that some of the non-integrated producers in the Pittsburgh area have begun to piece out their inadequate supply of operatives by hiring women for whatever tasks they can be trained. That accumulations of a number of war materials are now sufficient to permit easing of conservation regulations is certain, but it may be well to record the official attitude, expressed by Howard Coonley, WPB Director of Conservation, who stated it as follows: "The easing of many nonferrous metals and ferro-alloys is not an indication that restrictions of their use can be lifted or that any of them will be available soon for general use. The shift to Group II (materials in sufficient supply to meet war needs) from Group I (materials in insufficient supply to satisfy essential war demands) is significant chiefly because these materials in unfabricated form are now sufficient to supply essential war and industrial needs." Outstanding among the materials shifted from Group I to Group II was zinc, paucity in the available supply of which metal a few months ago was acute. While copper continues to be listed in Group I, recent unofficial surveys of the situation indicate that the findings of the United Nations Combined Committee to the effect that the Allies' copper supplies about balance their war requirements are reflected in marked improvement in the filling of orders by copper and brass fabricators. In the lighter metals, especially so in magnesium, the difficulty is not so much with the supply of metal as with fabricating facilities which, for the time being, have been outstripped by the phenomenal increase in metal output. To round out the picture, it may be recorded that Secretary of Commerce Jesse Jones recently testified before the House Small Business Committee that United States tin holdings, amounting to some 100,000 tons, sufficient to take care of essential requirements, should the war last another two years, are being added to at the rate of 30,000 tons a year by our infant tin-smelting and refining industry.

Plastic Engineers' Meeting and Show

As evidence of the constantly increasing interest in plastics, the relatively new Society of Plastics Engineers recently held an ambitious technical meeting combined with a display of plastics products in the Rackham Memorial Bldg., Detroit.

Among other things the exhibit stressed the outstanding role played by plastics in war production and the enormous savings made in critical materials through their use. One such item is a fuse, known as the M-52-B1, produced by a group of some 15 molders, which has conserved 10 million pounds of tin and 35 million pounds of aluminum, according to figures released by the SPE. In addition to the display of some of the largest thermoplastic and thermosetting moldings made in this country, there was shown a one-piece plastic molded antenna mast, said to be the first successful item of its kind produced in this country.

Also exhibited were examples of technique for producing electroplated finishes on plastics; and some automotive hardware items produced in plastics and electroplated to match various kinds of interior and exterior motor car treatment.

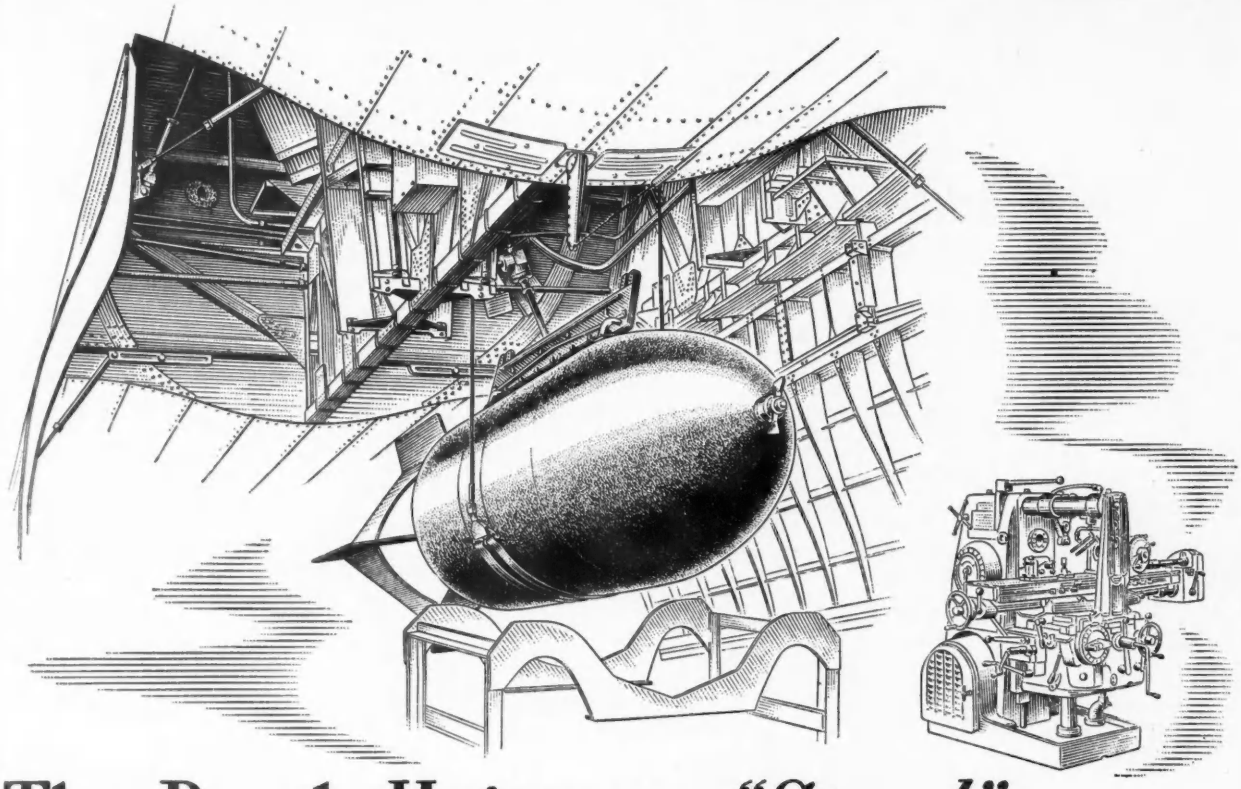
The technical program was highlighted by a talk on "plastics in the Motor Car Industry" by C. F. Kettering. Papers were presented by Dr. Franklin Strain, Columbia Chemical Div., Pittsburgh Plate Glass Co., on the properties of Columbia Allyl Resins; T. D. Perry, Resinous Products & Chemical Co., on Plywoods for War; Dr. Marie Bentivoglio, Celanese Corp., on the place of high acetyl cellulose acetate in the cellulosic family; and A. S. Cole on the subject of plastics in the post-war world.

An outstanding feature of the program was a round-table discussion on the birth of a molded product which was lead by W. D. Hoey, president of the Detroit Section, Society of Plastics Engineers.

"... the Cupboard Was Bare"

"We know that no one had planned to bankrupt private ownership of the aircraft industry in order that the Government can come in and take control, but if those who are advocating such control had sought a plan for that purpose they could not have found a better formula than: GREATLY EXPANDED SALES, PLUS LARGE INVENTORY RISKS, PLUS RENEGOTIATION, PLUS PRESENT TAX RATES, MINUS ADEQUATE POSTWAR RESERVES."—

Ralph S. Damon, vice-president and general manager of American Airlines, Inc., in a statement recently before House Ways and Means Committee.



The Bomb Hoist was *"Struck"* by Something in the Milling Machine

IT MAY BE NEWS to some that a part so long at home in milling machines proved equally effective in bomb ammunition hoists. For the milling machine is a precision tool in which ease and speed of operation are vital. Noted for its anti-friction operation, the Torrington Needle Bearing is used in some of the most famous of these tools to meet just such milling machine "musts" on various hand and power-operated trip levers.

With the bomb ammunition hoist ease of operation is, of course, important, too. But of even greater concern in these days of mightier and mightier "blockbusters" is the danger of overloading. Where bomb hoists do their work, "spares" and often adequate repair facilities may be painfully conspicuous by their absence. That's why the Needle Bearing scored a "direct hit" with the designers of bomb hoists—its high unit capacity helps prevent overloading or breakdowns, and low coefficient gives it a "made-to-order" operating ease.

The pay-off, however, is that this unique anti-friction bearing had several *other* features which helped build a better bomb hoist—its compact size saves weight, increasing maneuverability... its effective system of lubrication means less servicing attention required... its long service life speaks for itself... while the ready availability of the Needle Bearing eliminated one of the most frequent obstacles in war production—delay in delivery.

ISN'T THIS SOMETHING TO THINK ABOUT in planning your postwar designs? Not alone because of the Needle Bearing's adaptability to a wide variety of products for entirely different reasons, but also because its unique combination of advantages represent the very features customers will be looking for Tomorrow in the things for peacetime living—light weight, compactness, ease of operation, freedom from maintenance and long life. Torrington engineers are ready to point out how you can give your product these same advantages with the Needle Bearing. For preliminary information on sizes, types and ratings, together with a list of typical applications, send today for Catalog No. 107.

NEEDLE BEARINGS—ALL TYPES—ALL SIZES

NEEDLE BEARINGS TYPE DC are complete, self-contained units consisting of a full complement of rollers and a drawn, hardened outer race. They offer the advantages of small size, low cost, high capacity—and easy installation.

NEEDLE BEARINGS TYPE NCS consist of a full complement of rollers and a relatively heavy hardened outer race. They are furnished with or without inner races. Needle Bearings Type NCS are adaptable to heavier loads than Needle Bearings Type DC.

NEEDLE ROLLERS TYPE LN are produced in a range of types and sizes for assembly on the job into low-cost, high-capacity, anti-friction bearing units. Our engineering department will be glad to advise on the correct size and type for any application.

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TORRINGTON NEEDLE BEARINGS

Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the Oct. 15 issue of *Automotive* and *Aviation Industries* went to press.

AUTO-LITE BATTERY CORPORATION, Metal Manufacturing Division, Long Island City, N. Y.

THE DAVID BELL COMPANY, INCORPORATED, Main Plant, Buffalo, N. Y.

E. I. du PÓNT de NEMOURS & COMPANY, INC., Photo Products Department, Parlin, N. J.

FOOTE COMPANY, INC., Nunda, N. Y.

GENERAL MOTORS CORPORATION, Packard Electrical Division, Plant #4, Warren, Ohio.

HERMAN NELSON CORPORATION, Moline, Ill.

REED & PRINCE MANUFACTURING COMPANY, Worcester, Mass.

SONOCO PRODUCTS COMPANY, Hartsville Plant, Hartsville, S. C.

A third Star has been added to the Army-Navy "E" Pennant of the Farrel-Birmingham Company, Inc., Ansonia, Conn., for sustained excellence in production.

The Elastic Stop Nut Corporation of America has been awarded a war production citation by the Ordnance Department Industry Integration Committee for Tank Tracks. The company was cited for engineering and production achievements during a critical period in the manufacture of tanks.

Sun Opens New Plant For Aviation Gasoline

Completion and successful operation of a new plant exclusively for the manufacture of 100-octane aviation gasoline by the Sun Oil Company at its Marcus Hook, Pa., refinery, was announced Oct. 18 by J. Howard Pew, president.

The new plant—largest of its type in existence—was dedicated by Petroleum Administrator for War Harold L. Ickes on Oct. 27. The Sun Labor Management Committee arranged a colorful ceremony for the dedication of this aviation gasoline plant to the "heroic airmen of the United States." Representatives of the Army and Navy air forces participated in the ceremonies along with Administrator Ickes. This event was arranged as part of a continuing program to familiarize employes with the part they are playing in the war effort.

This aviation gasoline plant, constructed at a cost of $13,000,000, is the latest link in Sun Oil Company's program started in 1939 for the conversion of its facilities to maximum possible war production. This completes Sun's original war conversion plan costing approximately $20,000,000 and clears the way for the start of a second program. Altogether Sun Oil facilities costing over $36,000,000 are now devoted to war products at Marcus Hook alone, financed entirely by Sun Oil Company.

Obituary

Donald J. Campbell, 65, president of Campbell, Wyant & Cannon Foundry Co., Muskegon, died Oct. 11 at his home in Spring Lake, Mich., after a long illness. Campbell was one of the founders of the company, which moved to Muskegon from Chicago in 1908.

Daniel A. Andrews, sales executive with Continental Motors Corp., died Oct. 3 at Detroit. He had been with Continental since 1913. He was a member of the SAE.

Albert J. Dahlstrom, 53, chief inspector of the Chevrolet Gear & Axle Division of General Motors, died Oct. 15 at Detroit after a short illness.

William T. Cole, 81, for 30 years president and general manager of the Fabric Fire Hose Company, division of United States Rubber Company in Sandy Hook, Conn., died Oct. 9 at his home in Newtown, Conn.

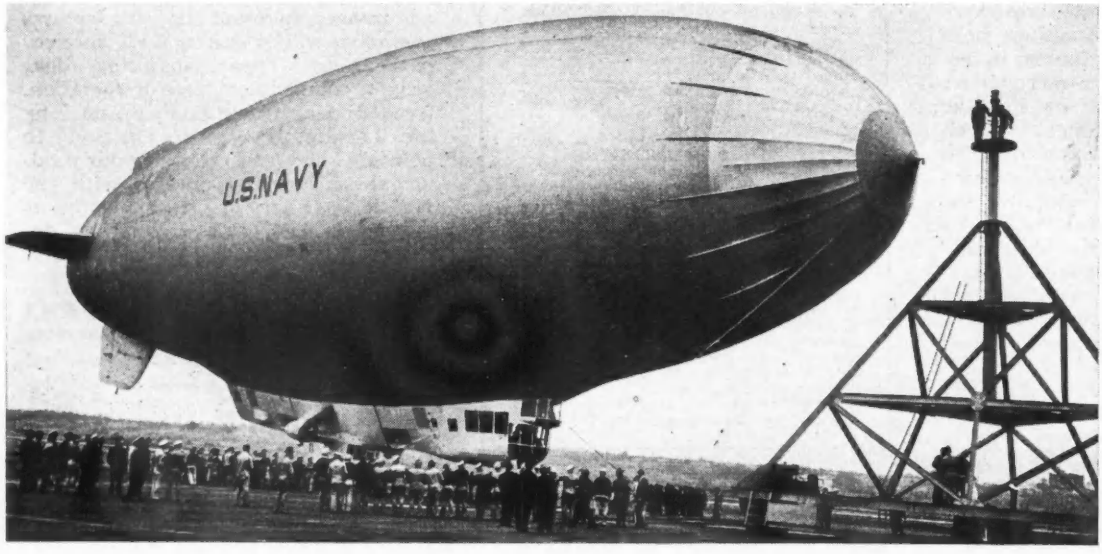
Aircraft Production Notes

Curtiss-Wright Corp. and Higgins Aircraft, Inc., have begun the manufacture of transport planes for the U. S. air forces on a scale never before attempted. The Curtiss C-46 Commando, a twin-engine plane capable of carrying a 10,000-lb load 1000 miles, is being produced in volume at Curtiss-Wright plants in Buffalo, St. Louis and Louisville and at the Higgins plant in New Orleans.

The first Lockheed C-69 Constellation was due to be delivered to the Army air forces in October. Forty of these planes were ordered by Transcontinental & Western Air Lines before the war and now are being delivered to the AAF. This is the largest U. S. land transport, having a wingspread of 123 ft and length of 95 ft. It is powered by four Wright 2000-hp R-3350 engines and has a cruising speed of 300 mph at 19,000 ft. It was designed essentially as a high altitude passenger plane and can carry 55 passengers at 30,000 to 35,000 ft.

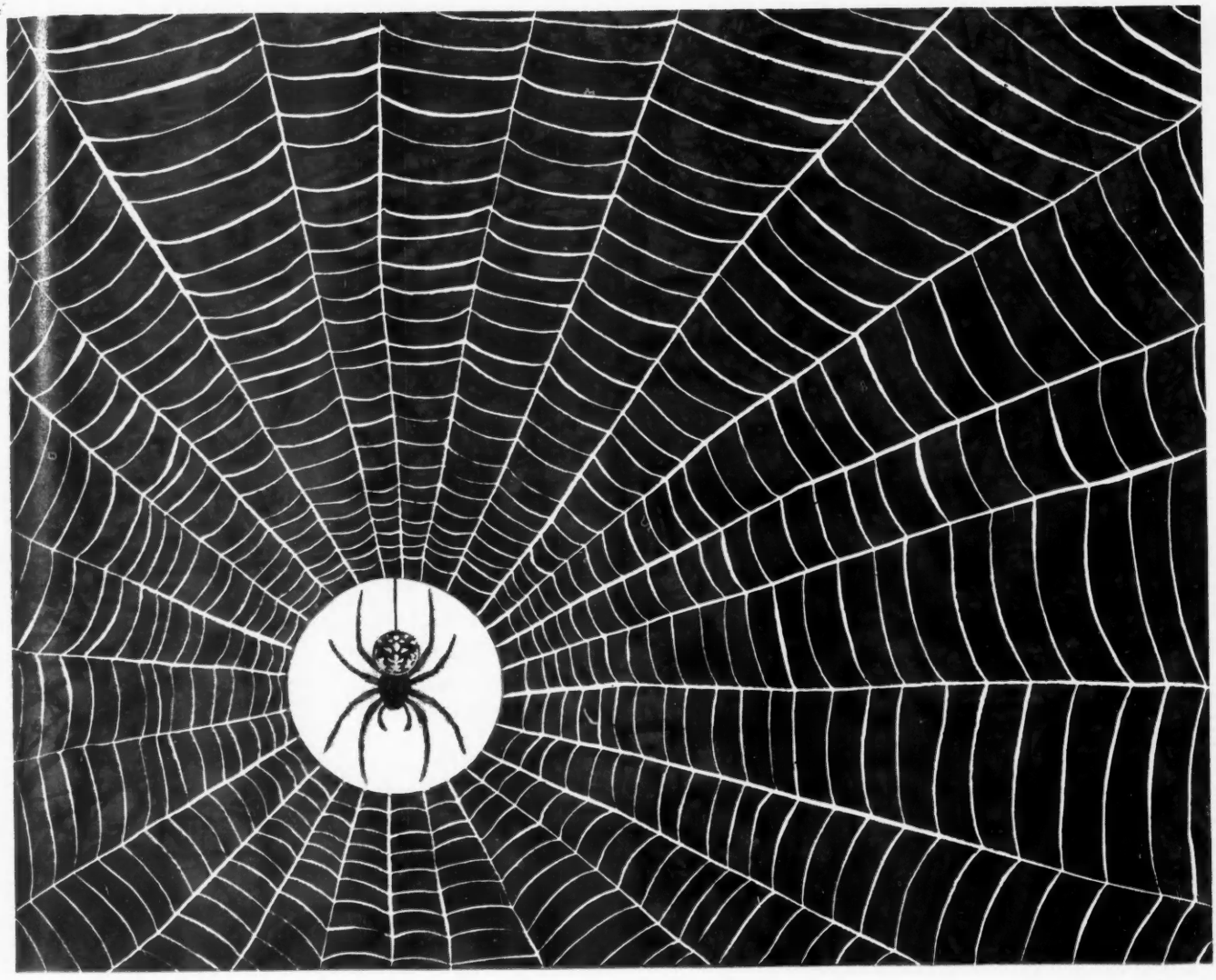
Pratt & Whitney Division of United Aircraft Corp. recently shipped its 100,000th engine since the first one was produced in December, 1925. The original was a 400-hp Wasp, which contrasts with the 2000-hp. Double Wasps being produced today for Republic P-47s and Vought Corsairs. It took 16 years, from 1925 to January, 1941, to produce the first 25,000 Pratt & Whitney engines and the other 75,000 have been made in 32 months. At ceremonies marking completion of the 100,000th engine, F. B. Rentschler, board chairman of United Aircraft, said P. & W. engineers have created an undisclosed addition to the Wasp family which they believe will be the division's most important engineering contribution to the winning of the war. August shipments of P. & W. engines from the East Hartford, Conn., plant totaled 5,000,000 hp.

Hayes Mfg. Corp., Grand Rapids, has received a contract from Bell Aircraft Corp. for the manufacture of complete wing assemblies and certain tail sections.



First of Navy's M-1 Series

Largest and newest of the Navy's nonrigid airships, the M-1, is shown here ready for flight tests at the Akron plant of Goodyear Aircraft Corp. It is 290 ft long and has a helium capacity of 650,000 cu ft, about 53 per cent greater than the K series patrol and escort ships. The M-ship, powered by two Pratt & Whitney Wasp engines, has a greater cruising radius and bomb-carrying capacity, and additional gun turrets. The car, which is over 100 ft long, consists of three connecting compartments integrated by flexible joints to allow freedom of motion in coordination with the envelope.



The story of a master weaver...

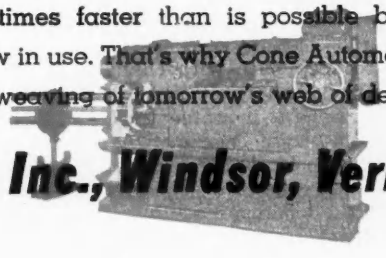
EVER WATCH a garden spider at work? It's no beauty itself—but what it can do in producing beauty! It weaves filaments of silk—silk it made itself—into strands 100 times finer than human hair, yet stronger than its equivalent in steel!

And because of its inexhaustible energy, it often completes an entire web in 30 or 40 minutes. This high-speed production requires extraordinary coordination of all 8 legs as the spider balances and guides the silken filaments into patterns of geometric perfection.

But if you think Nature can't be equalled, here's one to make a spider green with envy: On one job, a 2⅝" Six Spindle Conomatic in 12 seconds per piece completes 10 operations, one of which comprises drilling an eccentric hole without stopping the spindle. Operating 140 hours a week, Cone Multiple Spindle Automatic Lathes are today turning out millions of shell bodies and precision parts for guns, tanks, airplanes.

In peacetime, the mass production of metal parts is an economic necessity... in wartime, a military necessity. That's why the Cone Multiple Spindle Automatic Lathe, one of the key production machines of peacetime industry, is of such vital importance in wartime.

In the peace to come, Cone Multiple Spindle Automatic Lathes will be used in many operations for production **10 times faster** than is possible by many methods now in use. That's why Cone Automatics will help in the weaving of tomorrow's web of destiny.



CONE Automatic Machine Company, Inc., Windsor, Vermont

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Slightly reduced levels of general business activity have been indicated. The seasonally adjusted index of *The New York Times* for the week ended Oct. 9 stands at 137.0, as against 138.0 for the preceding week and 130.5 a year ago.

Retail sales were further enlivened in the week that included Columbus Day. Department store sales reported by the Federal Reserve Board for the week ended Oct. 9 were 9 per cent above the corresponding level last year. This gain contrasts with a decline of 5 per cent reported a week earlier. Sales for 1943 to date were 12 per cent greater than the comparable total a year ago.

Railway freight loadings during the week ended Oct. 9 totaled 906,276 cars, 0.5 per cent fewer than in the preceding week and 0.3 per cent below the corresponding number last year.

Electric power production declined slightly in the same period and was 17.3 per cent larger than the output a year ago, as against 18.4 per cent recorded a week earlier.

Crude oil production during the week ended Oct. 9 averaged 4,390,300 barrels daily, 62,800 barrels above the figure for the preceding week and 17,400 barrels more than the average recommended by the Petroleum Administration for War.

Bituminous coal production in the week ended Oct. 2 averaged 2,017,000 tons a day, as against 2,013,000 tons in the week before and 1,883,000 tons a year ago.

Engineering construction contracts awarded during the week ended Oct. 14 totaled $72,855,000, according to *Engineering News-Record*, as compared with $37,784,000 in the preceding week and $157,526,000 in the corresponding period last year.

Professor Fisher's index of wholesale commodity prices for the week ended Oct. 15 stands unchanged at 111.2 per cent of the 1926 average, as compared with 108.2 a year ago.

Member bank reserves increased $118,000,000 during the week ended Oct. 13, and excess reserves declined $90,000,000 to an estimated total of $1,610,000,000. Business loans of reporting member banks increased $41,000,000 in the same period but stood $305,000,000 below the total a year earlier.

ASA Revises Code For Abrasive Wheels

The American Standards Association announced approval of an important revision of the Abrasive Wheel Safety Code. This is the first revision of this Code since 1935. New sections have been added to keep pace with changes in the industry. Completely new rules have been written for mounted wheels. New speed rules have been drawn up for crankshaft grinding, camshaft grinding and thread grinding operations. While the basic speed tables remain the same, the Code has been carefully reviewed and many points have been clarified.

Need for a revision of the Code became increasingly apparent during the period of expanding war industries. Several types of abrasive wheels and grinding operations which previously had very limited usage, found an important place in the new industries. For some of these, there were no operating rules whatever in the old Code, while for others, it had been necessary to resort to the use of the permissible exceptions to existing rules. In some cases, the speed rules remain unchanged, and in others higher speeds have been approved if and when necessary, but always under proper control. Proper relationship between testing speed and operating speed for all classes of wheels has also been clarified.

New specifications are included for drawn steel protection hoods for portable grinders. This allows the use of lighter weight guards than were required by the specifications in the 1935 edition. It is hoped that this will encourage the wider use of guards on a class of work where enforcement of the rule on guarding is frequently lax.

CALENDAR

Conventions and Meetings

SAE Fuels & Lubricants Mtg., Tulsa, Nov. 4-5

Natl. Standard Parts Assoc. Management Planning Conference, Chicago Nov. 9-10

Natl. Aviation Planning Conference, Oklahoma City Nov. 11-13

Natl. Aviation Training Assoc., St. Louis—Convention Dec. 2-4

SAE Annual Mtg. & Eng. Display, Detroit Jan. 10-14

Machine Tool Builders Elect New Officers

At the forty-second annual convention of the National Machine Tool Builders' Association, held in Chicago, the following officers were elected for the 1943-44 term:

President, J. Y. Scott, president and treasurer of the Van Norman Co., Springfield, Mass.; first vice-president, Joseph L. Trecker, executive vice-president, Kearney & Trecker Corporation, Milwaukee, Wis.; second vice-president, William P. Kirk, vice-president and sales manager, Machinery Dept., Pratt & Whitney division, Niles-Bement-Pond Co., West Hartford. Conn.; treasurer, E. Blakeney Gleason, vice-president, Gleason Works, Rochester, N. Y.

The following new directors were elected: William P. Kirk, J. N. Kirkpatrick, president of the Landis Machine Co., Waynesboro, Pa.; and R. E. LeBlond, president of the R. K. LeBlond Machine Tool Co., Cincinnati.

PUBLICATIONS

An illustrated booklet, **Millionths of An Inch for Sale,** tells the story of the line of gages and inspection equipment made by the Vinco Corp. It describes spline gages, thread ring gages, involute spline gages, master gears, can comparators and other items. One of the most impressive of these is the Vinco optical dividing head which is said to have an accuracy to within two seconds of the arc.*

Merz Engineering Co. has released a new portfolio containing four folders describing and illustrating its four services. **Engineering,** experimental and research; the **standard gage division;** the **special gage and tool division** and the **manufacturing division.***

International Acetylene Assoc. has prepared a convenient, 16-page pocket-size booklet, **Preventing Welding and Cutting Fires,** which is for the purpose of instructing users of welding and cutting equipment in reducing potential fire losses.*

A new catalog on **Tantung Tools** has been released by Vascoloy-Ramet Corp. In addition to listing Tantung tools, the book contains valuable information on how to grind and how to braze Tantung. Performance data is also given, showing the results obtained by the use of Tantung in various machining operations.*

Lumarith Plastics is the title of a new folder issued by Celanese Celluloid Corp., Div. of Celanese Corp. of America Included in the folder are a few examples of the use of Lumarith plastics, properties of Lumarith, described and illustrated; types and forms—a tabulation of the various Celanese Plastics and the forms in which they are available: production—the methods used to convert Lumarith Plastics into finished parts and products.*

A new 4-page, 2-color bulletin, No. 201, has just been released by the Ransome Machinery Co. It presents the Ransome line of **welding positioning equipment,** including specifications, important features, load rating tables and dimensions.*

Two new bulletins, SM843, describing different models of **flame hardening** and special machinery, and PT845, describing several models of **hydraulic presses,** have just been released by the Hydraulic Machinery, Inc. Special machines included were built for the purpose of molding, bending, broaching, two-way drilling, piercing, etc.*

Continental Rubber Works has issued a new book on **Vitalic aircraft products,** made from rubber or the latest type synthetic. Sections included in the book are an aircraft mold and die index, illustrations of Vitalic aircraft products, specifications and a section on extruded rubber products.*

Fruehauf Trailer Co. has published a booklet, **Are the United States United?** It describes the havoc that state barriers create with transportation costs and how this means higher costs of living and higher costs of doing business.*

The B. F. Goodrich Co. has published a new folder on **Koron resins.** Tables of properties of unplasticized resins are included in the folder, together with a list of suggested applications.*

Federal Products Corp. has issued an instruction booklet for setting and using the Federal Model 1201 series of dial indicator hole gages. The booklet is of interest to those who use this particular gage and gives details on how to handle the gage, how to read it, how to set the gage and miscellaneous details all having to do with the proper handling and application of the dial indicator type of gage.*

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

Remember when it took weeks to assemble a plane? . . . . . Then came Pearl Harbor!

You know how those weeks were reduced to days. It was your ingenuity, your inventive genius, your dogged determination—through tired and red eyes from the need of sleep—that achieved America's miracle of production.

Many of you called upon Alvey-Ferguson for assistance. Then you whittled those days —to hours.

For Alvey-Ferguson *endless-stream* conveyor systems literally *"fly"* planes through plants. Parts move to men — not men to parts—at the most efficient pre-determined rate of speed.

Manpower is conserved. Floor space is conserved. But, most important—time is conserved!

Whatever *your* problems of "indoor transportation" and metal products cleaning and finishing (such as cleaning airplane engine parts, etc.), A-F Engineers can help you solve them. Write today.

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METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

PERSONALS

The appointment of **Frank P. Tighe** as director of public relations and advertising for the Houdry Process Corp. has been announced. Mr. Tighe, recently with the Press Division of the Office of Censorship in Washington, was for 12 years on the advertising and editorial staffs of CHILTON COMPANY. He was at one time publicity representative for Roche, Williams & Cunnyngham, Inc. Immediately before going to the Office of Censorship Mr. Tighe was general manager of the Philadelphia Automobile Trade Association.

J. M. Johns has been made general manager of industrial sales of Libbey-Owens-Ford Glass Co., succeeding the late G. L. Conley.

Worthington Pump and Machinery Corp. has announced the appointment of **Harry A. Erb** as service manager of the Moore Steam Turbine Div., Wellsville, N. Y.

Dorothy M. J. Tracey, vice-president of Tomkins-Johnson Co., has been appointed general manager. In this new capacity Mrs. Tracey succeeds **Mr. A. R. Johnson.**

Richard P. Brown, chairman of the board of the Brown Instrument Co. and vice-president of Minneapolis-Honeywell Regulator Co., has been named deputy director of the WPB, Third Region.

Ruth Tate, formerly with the Standard Oil Co., has been appointed women's representative in the owner relations div. of The Studebaker Corp.

Personnel changes at Lockheed Aircraft Corp. include the following: **Mort Bach** has been appointed works manager, with **F. Penn Holter** as assistant; **John H. Sreenan** is now general superintendent of outside plants.

Vega Aircraft Corp. has announced the following personnel changes: **George H. Prudden** succeeds Mort Bach as works manager, with **W. G. Dollmeyer** as assistant. **Harris McIntosh** becomes special assistant to the president in charge of management control.

Appointment of **A. N. Morton,** vice-president in charge of production for Mack Mfg. Corp., as a member of the advisory committee for the automotive, farm and tractor liquid-cooled gasoline engine industry, has been announced by the War Production Board.

Announcement has been made of the appointment of **Whitley B. Moore** as director of sales for all divisions of the Timken Roller Bearing Co. He is to be succeeded in his present position of general manager of sales of the Timken Steel and Tube Div. by **C. H. McCollam.**

Major General Walter R. Weaver, recently commanding general of the U. S. Army Air Forces Technical Training Command, has become associated with The Aviation Corp.

Thermoid Co. has announced the appointment of **Clarence B. Moore** as head of the Rubber Div. of Thermoid Research Laboratories and **Harry Bourne** as methods engineer in charge of hose production for the rubber div.

Charles M. Scribner of Chicago has been named a director of Transcontinental and Western Air, Inc.

Clyde Llewelyn has been elected vice-president in charge of operations of Bliss & Laughlin, Inc.

Frank H. Harrison, formerly manager of manufacturing for International Harvester Co., has been elected a vice-president of Curtiss-Wright Corp. **E. J. Harrington,** formerly coordinator of planning, production and material problems for Lockheed Aircraft Corp., also has been elected a vice-president of Curtiss-Wright.

Arthur W. Herrington, board chairman of Marmon-Herrington Co., Inc., has been awarded the honorary degree of doctor of engineering, in recognition of his achievements in the field of military transportation, by Rose Polytechnic Institute.

M. N. Trainer, vice-president of American Brake Shoe Co. and president of the brake shoe and castings division, has been elected first vice-president of the company.

Members of the recently named Consolidated Metal Cutting Tool Industry Advisory Committee of WPB are **C. W. Bettcher,** Eastern Machine Screw Corp., New Haven, Conn.; **E. H. Martindale,** Martindale Electric Co., Cleveland; **W. E. Caldwell,** Cleveland Twist Drill Co., Cleveland; **D. G. Millar** Greenfield Tap & Die Corp., Greenfield, Mass.; **H. R. Conners,** Detroit Broach Co., Detroit; **Charles M. Pond,** Pratt & Whitney Division of Niles-Bement-Pond Co., West Hartford, Conn.; **W. M. Dalzen,** Dalzen Tool & Mfg. Co., Detroit; **J. J. Prindiville, Jr.,** Lapointe Machine Tool Co., Hudson, Mass.; **Frank W. England,** Illinois Tool Works, Chicago; **Ernest C. Putnam,** Putnam Tool Co., Detroit; **Harry Fussner,** National Acme Co., Cleveland; **W. G. Robbins,** Carboloy Co., Detroit; **W. E. Loy,** Union Twist Drill Co., Athol, Mass.; **J. S. Storrs,** Tungsten Electric Corp., Union City, N. J.; **Franz T. Stone,** is the government presiding officer.

William J. Cronin, secretary of the Manufacturers Committee of the AMA and formerly manager of the Machine Tool and Equipment Service of the Automotive Council for War Production, has been appointed manager of the council's Manpower Division. **Harlan V. Hadley,** formerly of the council's war production information staff, has been named associate manager. **William P. Black,** editor of the council's manpower reporting service, has been made editor of the labor and personnel relations bulletin, Manpower Information.

Ralph W. Morrison, of Aro Equipment Corp., Bryan, Ohio, and **E. R. Wyler,** of Independent Pneumatic Tool Co., New York, have been named members of the Portable Pneumatic Tool Industry Advisory Committee of WPB.

Richard F. Eberline, of C. M. Hall Lamp Co., Detroit, has been named a member of the Aircraft Lighting Equipment Industry Advisory Committee of WPB.

J. C. Widman, formerly engineering and maintenance liaison engineer at Detroit, has been appointed superintendent of the engineering and quality division of the new Murray Corp. of America plant at Scranton, Pa. **E. Kruger** has been appointed production superintendent of the Scranton plant and **G. H. Bedenharn** has been named chief buyer.

D. A. Milligan, formerly equipment sales manager of Cleveland Tractor Co., has been appointed director of research for Harry Ferguson, Inc., distributor of Ford tractors.

Thomas H. Corpe, one-time director of advertising and sales promotion for Buick Motor Division of GM, has been named executive vice-president and general manager of Jordanoff Aviation Corp., New York City.

Raymond R. Dickey has been appointed manager of the new plastics division of Monroe Auto Equipment Co.

Lorenzo L. Snow, formerly Washington representative of the Pratt & Whitney Aircraft Division, has been named manager of the Airport Division of United Aircraft Corp., succeeding B. L. Whelan, who recently became general manager of the Sikorsky Aircraft Division.

R. D. McKnight has been appointed advertising manager of Federal Motor Truck Co., succeeding Earl Vernier, resigned.

Mrs. Allaire C. duPont, widow of Richard C. duPont, who was killed recently in a glider accident in California, has been elected a director of All-American Aviation, Inc.

M. A. Moynihan has retired as secretary-treasurer of Gemmer Mfg. Co. He was one of the company founders in 1906. **George E. Trimm,** former assistant secretary and assistant treasurer, has been named treasurer and **Edward P. Hammond, Jr.,** has been elected secretary. **Charles F. Hammond, Jr.,** former experimental engineer, has been appointed vice-president in charge of engineering and **Frank E. Phillips,** former assistant sales manager and export sales manager, has been named vice-president in charge of sales.

Wrought Coppers and Copper-Base Alloys

The Copper and Brass Research Association has issued a list of 38 standard commercial wrought coppers and copper-base alloys which, over a period of years, have been the ones most commonly ordered in large quantities by consumers. The alloys listed will serve most of the requirements for both war and peacetime products. Special and proprietary alloys will, of course, continue to be available for the particular uses for which they are specifically required, but it is believed the listing of these standard alloys will materially simplify the preparation of engineering specifications. It is planned to supplement this list of alloys by data sheets covering physical and chemical characteristics applicable to each of these alloys.

CENSORED

An exclusive feature prepared by M. W. Bourdon, special correspondent of Automotive and Aviation Industries in Great Britain.

In view of the short supply of aluminum, the Director of Vehicle Maintenance at the Ministry of War Transport offers advice, information and demonstrations on the reconditioning of aluminum top and bottom tanks of radiators. He states that large numbers of these parts have been needlessly scrapped by truck operators when they have been found porous or perforated by corrosion; with few exceptions, he adds, they could have been made serviceable again by welding.

Because of many complaints that tires submitted for reconditioning have been scrapped by official repairers as unfit for retreading, despite their being fit for considerable further use without having new treads, the Tire Controller has ordered that such tires in future are to be branded "R.O." (i.e. run out) by retreaders and returned for further use by their owners at the latter's discretion.

A "Safety Training" exhibition has been running in London. Although by no means wholly devoted to road transport, it has almost the layout of the accessories section of a pre-war motor show. Both floors of the Dorland Hall where it is staged are covered with displays showing how, in one way or another, accidents are caused and how they can be avoided.

Machine drawings are now being sent by airgraph by Dunlops in England to the plants in India, South Africa and Canada. Two processes are being utilized. In one case the drawings are made on the airgraph form itself (which measures 8¼ in. by 10¼ in.) and then, as usual with airgraph letters, photographed on to a film no bigger than a small postage stamp for transport by airplane and enlarged on arrival to half the original size. In the alternative process, the original drawing is reduced to airgraph letter size by the Dunlop photographer, then sent by airgraph and brought up to original size on receipt. To reach their destination the airgraph drawings take about one-third of the time occupied by boat and the risk of loss is negligible.

Here's Help to Avoid Tool Hardening Troubles that Interfere with War Production . . .

Getting hardening results that assure the kind of tools that give longer uninterrupted production is largely a matter of two things. First, having the right steel. Second, having complete heat treating data. And on each of these points, Carpenter is prepared to help you.

The Carpenter Matched Set Method of tool steel selection provides you with a system for selecting the *one* steel that is best for each tool you make.

For help in heat treating the Carpenter Matched Tool Steels, your nearby Carpenter representative will be glad to give you the benefit of his long practical experience. He can render on-the-spot service—keep you in touch with our Metallurgical Department—and supply you with literature packed with helpful information. Here, for example, is basic information on the laws of quenching.

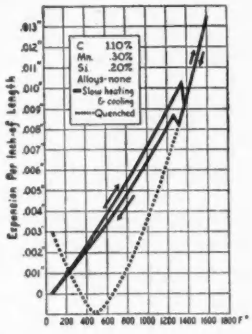
The Four Fundamental Laws of Quenching

LAW NO. 1—Steel is stronger cold than hot. Every one knows that steel is easier to bend, shape or deform when it is hot. Therefore, when hot steel comes into conflict with cold steel, the cold steel always wins. *(This law explains why a steel rod quenched horizontally will warp upward at the ends.)*

LAW NO. 2—Steel expands when heated and contracts when cooled. This is illustrated by the solid curve in the chart, which shows the behavior of a piece of high carbon tool steel heated and cooled slowly in a furnace. Starting at room temperature, the steel gradually expands up to about 1350°F. when it will be about .010" longer per inch than it was when it started. Here, it reaches the critical point, and while going through the critical, it shrinks somewhat. Above the critical, it continues to expand at a more rapid rate.

On cooling slowly, it shrinks until it reaches about 1310°F., expands while going through the critical and then shrinks back to its original size as room temperature is reached. *(The importance of this law is obvious—since, if different parts of a tool are not cooling at the same rate, stresses will be set up in proportion to the difference in cooling rates.)*

LAW NO. 3—Some tool steels increase in volume when hardened. This is particularly true of water-hardening tool steels. The dotted line in the chart shows the approximate course through which carbon tool steel would travel if it were quenched instead of being cooled slowly. It would continue to shrink (without any critical point interruption) to some temperature in the neighborhood of 500°F. As it cooled below this temperature, it would expand until it would finally be about .003" per inch longer than it was when it started in the annealed condition. *(This law explains why some tools change size in hardening and why some break in the quenching bath. Size change as such is not necessarily disastrous, but if the volume change in part of the tool differs greatly from that in an adjacent part, cracking may result.)*



LAW NO. 4—All steels when stressed under the elastic limit have the same elastic properties—regardless of composition or heat treatment. This may seem impossible, but it is true nevertheless. All steel, regardless of its analysis or heat treatment will stretch exactly .001" per inch under a load of 30,000 lbs. per sq. in. *(This law makes possible the measurement of internal stresses in a piece of quenched tool steel, by simply measuring the amount of distortion. By such a study, it is possible to obtain information to control the quenching operation so as to minimize warpage and breakage.)*

Much helpful information on quenching, like that above, is contained in "Tool Steel Simplified". It is only a small part of the practical information on tool making given in the book. You can put all its useful facts to work in your tool room by making copies available to your tool room men. "Tool Steel Simplified" is available *at cost*, $1.00, in the U. S. A.—$3.50 elsewhere.

THE CARPENTER STEEL COMPANY
103 Bern Street, Reading, Pennsylvania

Carpenter MATCHED TOOL STEELS

Continental Aviation to Make Rolls-Royce Merlin Engines

(*Continued from page* 46)

tures Oerlikon 20-mm. anti-aircraft guns, gun mounts, fire control apparatus, torpedo tubes and other naval ordnance. It also serves as a repair and replacement center for guns and naval ordnance from the U. S. fleets which have suffered combat damage. The plant is a permanent Navy installation and is one of five naval ordnance plants which have been established west of the Alleghenies for strategic reasons to serve as auxiliaries to the Naval Gun Factory at Washington. The others are a rehabilitated gun and armor plate plant at South Charleston, W. Va., a fuse loading plant at Macon, Ga., a plant for manufacturing miscellaneous parts at Canton, Ohio, and an assembly plant at Louisville. The latter two are operated by Westinghouse.

The cancellation will not affect Hudson's other Navy contracts for Invader marine engines and mine anchors as well as wings for Curtiss SB-2-C1 Helldive bombers. Hudson's production of Wright aircraft engine parts and airframe subassemblies is due to be augmented by two new contracts for bomber wings and fuselage sections for the Bell P-39 Airacobra.

Buick Motor Division of GM has produced 25,000 Pratt & Whitney R-1830-43 radial aircraft engines since the first one was turned out in January, 1942, H. H. Curtice, general manager, has announced. Output of these 14-cylinder 1,200-hp. engines now aggregates 4,000,000 hp. per month and schedules are increasing at Buick's new Melrose Park, Ill., plant. These engines are installed in the B-24 Liberator bombers produced by Consolidated, Ford and other manufacturers.

Aluminum Co. of America has expanded its aluminum forging capacity to 45 times its peace-time peak to meet the tremendous demand for aircraft forgings in the nation's constantly increasing military airplane program, which calls for a 50 per cent increase in 1944 schedules over this year's output. Alcoa has expended $250,000,000 of its own money in enlarging company facilities. Alcoa also has designed, built and is operating on short-term leave for the government 40 separate plant projects, whose combined production is greater than that of Alcoa. Other companies such as Reynolds Metals also have greatly expanded their facilities. Aluminum accounts for 75 per cent of the average warplane's weight. Of the aluminum going into military planes, forgings comprise 11 per cent, sheet 48 per cent, extruded shapes 13 per cent, wire, rod and bar 5 per cent, castings 7 per cent and tubing 3 per cent. Alcoa's capacity for making aluminum sheet will have been expanded seven-fold, that for extruded shapes 10 times, wire rod and bar capacity 25 times, castings seven times and tubing 12-fold. The nation's wartime goal is annual production of 2,100,000,000 pounds of aluminum.

Chevrolet Motor Division of GM has increased its aluminum aircraft forging production 10-fold in 1943 over 1942 on a poundage basis. In each of the last three months of 1943 Chevrolet will turn out more aluminum forgings than were produced in all of 1942. Fourth quarter output is estimated at more than 2½ times that for the first quarter of 1943. Chevrolet operates aluminum forge plants at Saginaw, Muncie, Ind., and Anderson, Ind. Chevrolet recently was assigned a new forging project for 96¼-inch propeller blades. This is one of four different blade sizes, ranging from 67 inches to the new 8-foot model, which are being forged by Chevrolet at Saginaw. Crankcase sections, gear trunnions and other forgings also are produced in Chevrolet aluminum foundries on a volume basis.

WE NOMINATE FOR GLORY

Gentlemen, he's tired. This patient and venerable creature is the most overworked piece of machinery in the world. For countless centuries the old one-horsepower hay burner was the most efficient engine we had, and he has done much of this world's work.

Today, aeronautical engineers have packed a horsepower into a few ounces of metal, and more than 2,000 horsepower into a single engine. Tolerances are measured in thousandths of an inch, and bearing smoothness is measured in millionths.

There's a reason for such precision as this. Into the cylinders of that finished engine will pour a torrent of 15-ton explosions at the rate of hundreds of blasts every second during the million miles of flight that is the life expectancy of the engine.

And that, brother, is horsepower!

Today, Jones & Lamson machine tools, engineers and service men will be found on every airplane engine production line in America, helping to make possible this miracle of power . . . They are at your service. Call upon them now.

Universal Turret Lathes . Fay Automatic Lathes . Automatic Thread Grinders . Optical Comparators . Automatic Opening Threading Dies

JONES & LAMSON MACHINE CO., SPRINGFIELD, VERMONT, U.S.A.

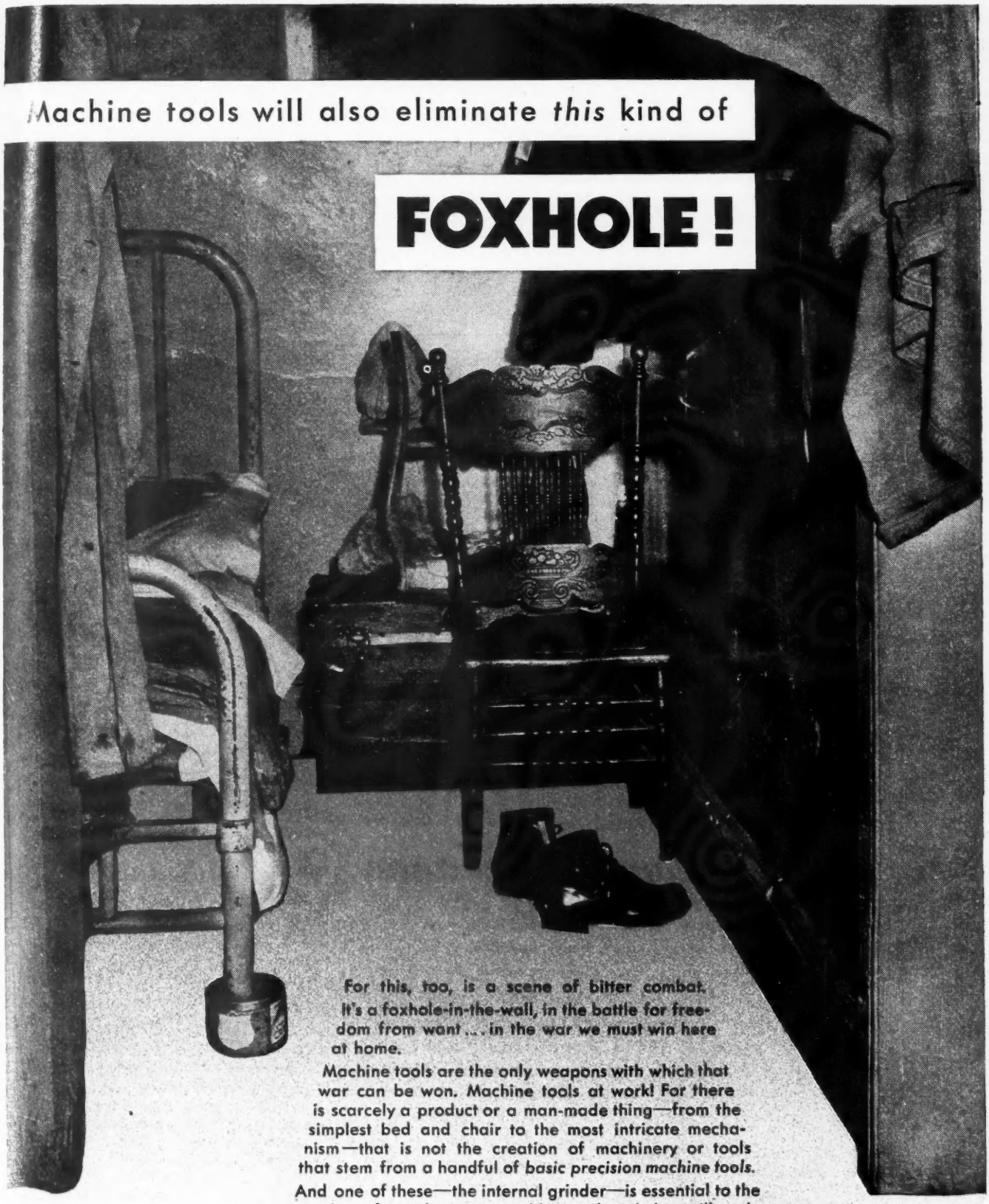
Profit-producing Machine Tools

Hydraulic Control of Temperature

(*Continued from page* 25)

selector valve, which in a sense is an amplifier, as a small work-load of the order of one one-hundredth or two hundredths of an in.-pound of work will cause or prohibit the operation of one horsepower of net work at the flap, the smaller work being provided by the thermal element. The four-way selector valve operation controls the flow of hydraulic oil, usually at 1500 pounds pressure, to the hydraulic cylinder or strut, which in turn operates the air-controlling flap. This arrangement is additionally effective in that hydraulic oil or pressure is readily convertible to force in its most usable form insofar as flap operation is concerned, hence the efficiency of this work-doing medium is very high.

The most desirable type of control is one that will *modulate* the flap, that is, not open or close only, but assume some position best suited to obtain the correct temperature control. Operating efficiency of the engine installation virtually requires modulating control, not only to maintain actual engine efficiency by holding correct temperatures, but maximum aerodynamic efficiency by lessening unnecessary flap opening. However, modulating controls have an inherent weakness, that is, a tendency toward instability or a tendency to "hunt" or oscillate about the desired position. This is overcome in nearly all modulating mechanisms by what is known as the reset or follow-up mechanism. This mechanism readjusts the calibration point of the temperature control for the particular flap position. Thus, when the engine is cold, and the flaps are closed, the temperature control will respond at a temperature 20, 30, or 40F, as the case may be, lower than it would if the flaps were open. A typical modulating control does not have a fixed temperature responsive point in the sense that a typical thermostat has. For example, a typical on-and-off thermostat would turn on at a certain temperature, say 210F. and turn off at 220F. The modulating control may start at 210F. and initiate opening of the flap—the resultant operation of which would shift the range of the control, resulting in a small movement suited to the cooling needs. The flap would not go fully open, but would open, for example, 20 per cent, and, in addition, the control point or response point of the control would be shifted from 210 to 216F. Further rise in temperature would cause a further opening of the flaps an increment suited to the rise of temperature. The flaps would be fully open, for example, at 240F., and the new response point of the control, because of the rest mechanism, would be at 240F. Drop in temperature be-



Machine tools will also eliminate *this* kind of

FOXHOLE!

For this, too, is a scene of bitter combat. It's a foxhole-in-the-wall, in the battle for freedom from want ... in the war we must win here at home.

Machine tools are the only weapons with which that war can be won. Machine tools at work! For there is scarcely a product or a man-made thing—from the simplest bed and chair to the most intricate mechanism—that is not the creation of machinery or tools that stem from a handful of *basic precision machine tools.*

And one of these—the internal grinder—is essential to the creation of nearly every machine and tool that will make for a finer standard of living after this war.

It is because of this that the job ahead of us, here at Bryant, will continue to be a truly great one when the war is won.

Call on us!

BRYANT CHUCKING GRINDER COMPANY Springfield, Vermont, U. S. A.

low 240F. would result in a closing of the flap again an incremental amount. Thus, with a reset mechanism, an actual closing condition is obtained which may be higher in temperature response than another point at the flaps would open. The reset mechanism is solely responsible for this condition, and ideally prevents "hunting."

The range, in this case from 210 to 240F., is known as the reset range. As compared to the on-and-off control first mentioned, it appears to be wide. However, the on-and-off control is subject to swing-in control, so that, for example, a control which shuts off at 220F. as mentioned above does not result in holding the medium at 220F. but allows it to rise greatly beyond this, depending upon the characteristics of the medium and system on which the control is being used. A properly designed reset range, however, will result in holding the control temperature entirely within the reset range, particularly if the control is rapidly responsive. Hence, although the reset range of the modulating control is wider than the differential of typical on-and-off controls, the actual control temperature is more often closer or narrower than that obtained with an on-and-off type.

Operation of the hydraulic control is fast enough to cover all flying conditions, even those existing in pursuit ships. Actual test curves on one of the fast pursuits shows that the control is never lost and that the control never has to over-shoot to catch up with its position. Also, overriding or pilot supervision is just as effective as if the control never existed. The weight is low; field experience and operating life have been proven satisfactory. Further advancement indicates that air-cooled engine cowl flap control is also solvable hydraulically.

BOOKS . . . .

As an instructor in aircraft recognition, Squadron Leader G. E. Wilson found that most students had difficulty visualizing aircraft in various flying positions from two dimensional black and white silhouettes. As every aircraft has some unusual feature, he caricatured these as they are actually seen in three dimensional blackboard chalk talks. This system was so successful that he was encouraged to prepare finished drawings, emphasizing the most important recognition features from each angle, of planes on the course of study of the Combined Training Organization of the R.C.A.F. and R.A.F. The result is "AIRCRAFT IDENTIFICATION FOR FIGHTING AIRMEN," *by Squadron Leader G. E. Wilson. Published by David McKay Company, Philadelphia, Pa.* This book simplifies the important subject of aircraft identification in text and with over 500 special drawings which emphasize in proportion and shading over 1500 characteristics of the most important types of aircraft on the syllabus of training in the R.C.A.F. Each plane is described and illustrated in a double page spread measuring nine inches high and fourteen inches wide. In addition there are 52 photographs of planes in action for use as identification tests.

Kennametal Tools Ground Ready for Use

A LINE of solid round Kennametal tools already ground ready for immediate use in precision boring machines, is announced by Kennametal, Inc., Latrobe, Pa.

These new tools are designated as the 27SR, having a side cutting edge angle of 30 deg and an end cutting edge angle of 38 deg, for use primarily in a 30 deg boring bar; and the 29SR having corresponding angles of 45 deg and 53 deg, for use primarily in a 45 deg boring bar.

Five sizes are available in each style, 3/32 in., ⅛ in., 5/32 in., 3/16 in., and ¼ in. Tolerances are held to +.000 in. and —.001 in. on the diameter, and to +.000 in. and .005 in. on all other dimensions.

for Your Screw Driving Army

NO PRACTICE NEEDED TO DRIVE PHILLIPS SCREWS . . .

It's no problem to replace men who have left your screw driving army for the fighting front, *if you use Phillips Recessed Head Screws.* Anybody can "take over", without training, and do a good job!

The scientifically designed Phillips Recess makes screw driving fool-proof. It automatically centers the driving force and eliminates all driving troubles . . . fumbling, wobbly starts . . . slant-driven screws . . . burred and broken screw heads . . . and dangerous screw driver skids.

Screw and driver "become one unit", making such efficient use of turning power that driving is much easier and faster, regardless of driving method. And, power driving is made practical.

Compare the cost of driving Phillips and slotted head screws. You'll find that it actually costs less to have the advantages of the Phillips Recess!

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

New Products for Aircraft

(*Continued from page* 37)

and air filter; pressure relief valve for limiting De-Icer system air pressure and an electrically controlled unloading valve for unloading the air pumps when the De-Icers are not being operated, provides a compact light weight, easily serviceable system with plumbing reduced to a minimum through the incorporation of single span-wise suction and pressure manifolds.

The Eclipse Manifold-Solenoid system with Electronic Control is said to assure positive ice removal under all flight conditions.

More Models of Hose Clamps

With the addition of Models M-6 and M-10, the Aero-Seal line of hose clamps, manufactured by Aircraft Standard Parts Company, Rockford, Ill., now covers, in 16 models, all sizes of standard aircraft hose from ¼ in. inside diameter up to 4 in. The M-6 is designed for ¼ in., ⅜ in., and ½ in. hose; the M-10 fits ⅝ in. and ¾ in. hose. By using the extra take-up in the band, the M-10 can be used on all five hose sizes from ¼ in. to ¾ in. inside diameter.

This feature provides a wide clamping range. The band is a spring steel strip perforated to correspond with the teeth of a worm gear. It is drawn through the housing by a worm thumbscrew which provides rapid action in tightening the clamp. Since the perforations in the band extend for nearly

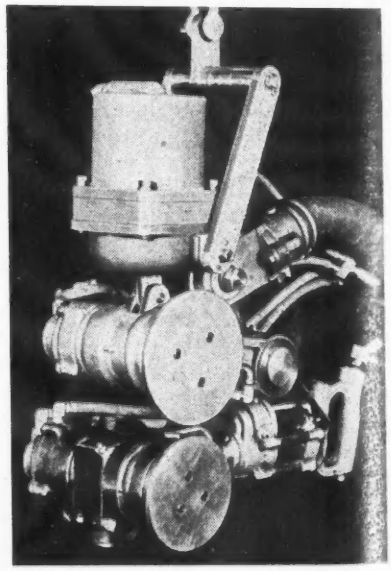
Aero-Seal hose clamp

3½ in., the clamp may be taken up a full inch (in the larger sizes) on diameter. Where some sizes may be missing from stock, a larger size can be used and simply drawn up until it is tight.

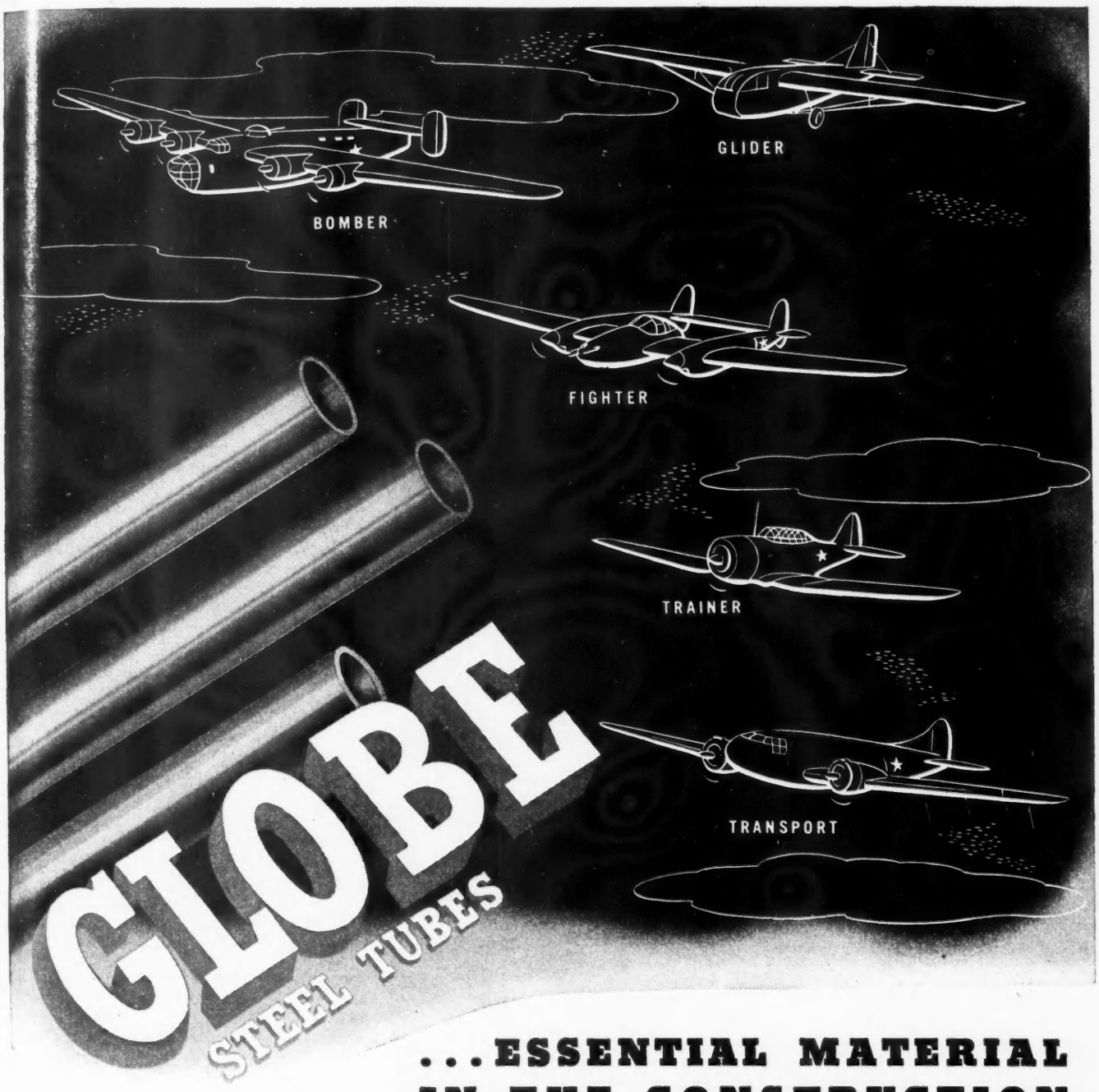
Air Operated Seam Welding Gun

An air-operated portable gun with which parts that are too big to "take to the machine"—and also large assemblies which are mounted in stationary fixtures—can be seam-welded, has been announced by Progressive Welder Company, Detroit, Mich. This is said to be the first practical portable seam-welder available to industry.

The machine has been designed for welding steel up to two thicknesses of



Air-operated portable seam welding gun



...ESSENTIAL MATERIAL IN THE CONSTRUCTION OF MODERN AIRCRAFT

MORE than 83 different parts used in modern aircraft construction involve the use of Globe Steel Tubes — including Globe seamless carbon, alloy and stainless steel tubes, as well as Gloweld welded stainless steel tubing.

Great structural strength with minimum weight—adaptability and easy machine-ability — uniformity — qualify Globe steel tubes for applications ranging from small stator shells in fractional horsepower motors, as used aboard planes, to sturdy cylinders required for hydraulic landing gear.

Boiler & Pressure Tubes
Condenser & Heat Exchanger Tubes
Mechanical Tubing
Stainless Tubes (Seamless)

GLOBE TUBES

• Stainless Tubes (Seamless)
• Gloweld Tubes (Welded Stainless)
• Globeiron Tubes (Seamless Pure Iron)

Carbon — Alloy — Stainless Steels

GLOBE STEEL TUBES CO. MILWAUKEE, WIS., U. S. A.

20 gage, including stainless steels. The gun is universally suspended and can be swiveled about so that the operator can weld in almost any direction, horizontally or vertically.

Features of this new seam-welding gun include a head operated by an air motor using 42 cu ft of air per minute under load. The motor is rated at 2 hp when run at a constant speed. Its standard speed is between 48 and 52 in. per minute, using standard rolls or wheels. A governor regulates the speed of the air motor.

Since this gun has been specifically designed for welding long seams or shorter seams on large parts, it requires a high duty cycle and high current densities to make its portability practical. This has necessitated provision for a large volume of water to give the proper cooling. About 5 gallons a minute is required to obtain optimum performance from the welder. The transformer, cable, jumper, and bushings are all water cooled. The wheels are cooled internally, but spray cooling for the external parts of the wheels is available if needed.

The gun has a throat depth of 3 in. Its stroke is ½ in. when the wheels are new, and 2 in. maximum when the wheels are worn.

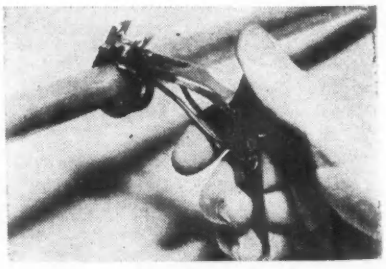
A dial type switch with six stages of heat selection, located on the transformer, permits heat control. The transformer is rated at 100 kva, is water cooled, and operates at 440 volts 60 cycles. The recommended maximum duty is 2 cycles "on" (welding); and 4 cycles "off" (cooling). The cable is 750,000 cm concentric kickless type.

Assembling Tool for Support Clips

Assembly of aircraft pipe, tube and conduit line support clips may be speeded up through use of a new clip assembling tool now being produced by Adel Precision Products Corp., Burbank, Cal. In addition to saving time, the tool is said to save workers, most of whom are now women, from extreme finger fatigue since thumb and forefinger become less tired. Possibility of injury to fingers and finger nails is also reduced.

The clip assembly tool consists of a metal handle in two parts which are joined at a fulcrum for leverage plus a formed wire which is attached to the

(*Turn to page 69, please*)



Adel clip assembling tool

(*Continued from page* 64)

underside of the handle and extends along the anvil to act as a pincer.

When the handle is jack-knifed, the pincers may be placed over the open ends of the clip, as shown in the illustration. By grasping the back part of the handle, with an easy pressure of the thumb and a slight pull of the fingers, the handle is straightened and the ends of the clip are brought together.

At this point, the clip may be permanently fastened. Many operators prefer, however, in sub-assembly work to make a temporary closure by applying the small Adel easy assembling latch. This latch permits pre-assembly of a number of clips at one time which may be secured later in groups thus saving additional time through fewer changes of tools.

When handle is completely open, the tool may be quickly disengaged. It may be operated in any of four positions; approaching the clip from front, back, above or below. Its compact size permits use in close quarters.

Starter Test Stand

The new Amsco Starter Test Stand, which has just been introduced by the Airplane Manufacturing and Supply Corporation, North Hollywood, Cal., has simplified the operation by providing a single mounting plate for right or left direction S.A.E. 5, 6 or 7-in. aircraft starters. Starter tests are obtained by the torque action of the starter transmitted through a two-way torque arm to a double-action hydraulic cylinder which in turn registers in foot-pounds on a maximum limit hand pressure gage.

Amsco Starter Test Stand

The usual gage furnished with this tester stand allows readings up to 2800 foot-pounds pressure on most all known aircraft starters. Other gages may be supplied, however, allowing any reasonable capacity rating. An ammeter is mounted on the instrument panel allowing check of starter motor "draw" during flywheel energizing. All other necessary switches, including a selector switch for 12 or 24 volt operation, are a part of the panel set-up.

The Amsco Test Stand is arranged in a cabinet 38 in. high, 36 in. wide and 28 in deep. All wiring and moving parts are enclosed. Ball-bearing casters allow it to be wheeled throughout the shop.

Contract Termination

(*Continued from page* 17)

products cannot stand much delay in payment after termination. Needed are methods by which at least a major portion of the sum involved can be disbursed immediately so that working capital will be available for the reconversion job.

Third is to establish how to deal with sub-contractors, or how the sub-contractor is to deal with the prime contractor. Utilization of sub-contractors by the thousands under single prime contracts and in many cases, interlocking under hundreds of separate

prime contracts has been a conspicuous feature of the war production program. Secondary contractors are as much in need of prompt and equitable settlements as prime contractors. Many of the small companies and many sub-contractors would be bankrupt by protracted delays in settlement.

The fourth point is how to get a fair allowance for costs incurred. It is necessary to arrive at some just and equitable procedure which will not run into long and involved negotiations.

As a corollary is the fifth point of how to get the costs of termination so that they will be reasonably determined costs, rather than being decided on such a restrictive basis that there would not be recovery of fair costs.

Sixth, what to do about so-called common items of material and equipment in cases where there are several different contracts. Would there be proper allocation of material to cancel the contract, or would it be pushed over from one cancelled contract to a new contract which would subsequently cancel it?

Seventh, how to avoid interminable auditing of cost.

Eighth, question of what to do about fabricated material that could be sold on the market and treated as service parts, interfering with future business of the contractor.

Adequate Government Machinery Needed

The solution of the above and other problems will require the creation of adequate governmental organization, fully empowered to effect prompt and final settlement. A clear understanding of the ground rules by both Government and industry will expedite settlement. The equitable handling of the demobilization program cannot be obtained unless all agencies concerned in procurement, accounting and fiscal policy operate under definite, clearly established and dependable measures.

A sound liquidation program will require settlements that are fair both to the tax-paying public and to contractors. Emphasis and re-emphasis must be put on the fact that the public interests cannot be well served if the making of equitable settlements is so delayed as to interfere with the speedy re-conversion to civilian production. Any program must keep in mind the fact that, from the physical side, a formidable problem may result from the billions of dollars' worth of machine tools and equipment which are owned by the Government.

It is imperative that these tools do not linger in private plants to block the program of civilian production. The manner in which industry swiftly moved its own tools out of the plants as an initial step in converting to war production provided a memorable precedent which the Government could well study in making its plan to authorize removal of its equipment. If this is not done, millions will be out of work longer than necessary.

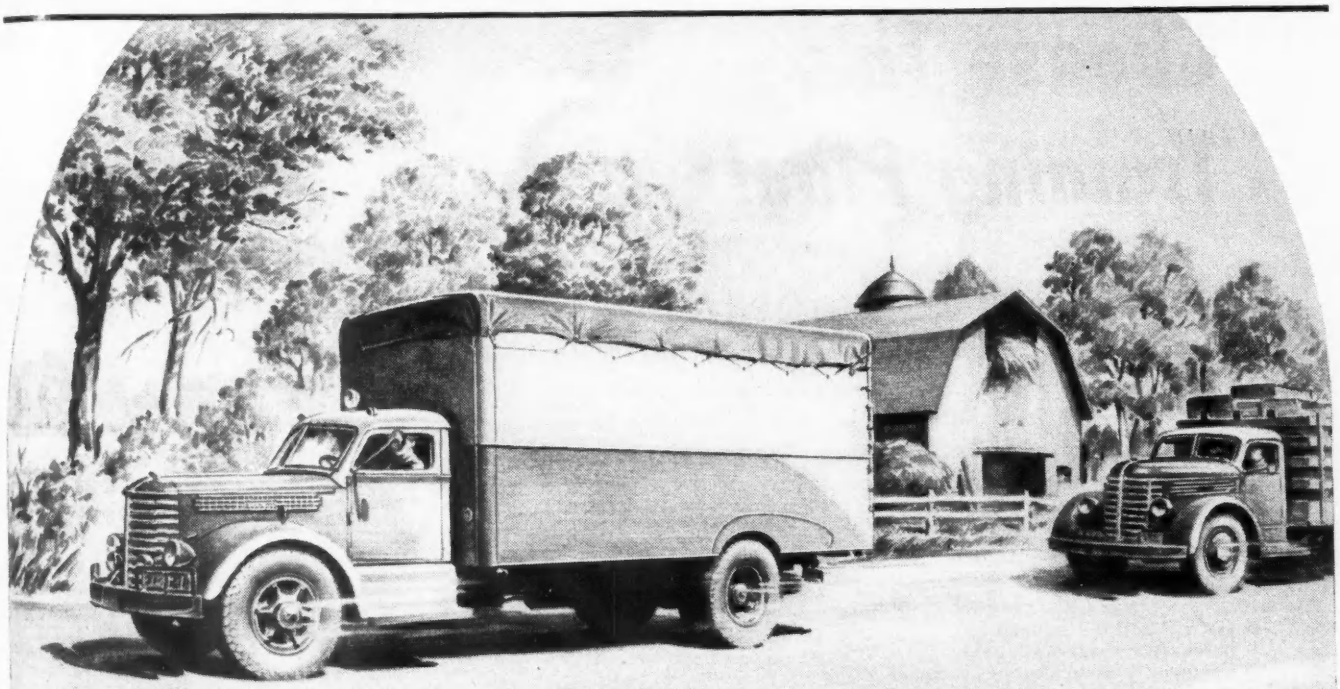
Floors Full of War Materials

Also, the typical war plant will have its floors full of war materials when hostilities cease. So long as this war material is held in the plant pending the Government's final valuation of work performed, or decision as to its disposal, the plant and its capital cannot be turned back to peace production. Provision for the immediate removal of such materials should be part of the program to clear the way for re-employment.

Government demobilization plans should also include a definite program as to plants and tools to be retained and provisions for disposal of such Government-owned buildings, sites and tools as are not to be retained.

Manifestly, the need is for a vital, overall national program to deal with these problems. The ability of the automotive industry and many other industries to perform will depend, in large measure, on the success of Government in working out successful termination procedures. It is industry's job to present documented facts bearing on their individual problems to the attention of the government. And it is the Government's responsibility to assign competent men and establish necessary machinery to handle the many problems of this complex activity.

PLANNING AHEAD FOR • • • • THE TRUCKS OF TOMORROW



When peace-time production of trucks is resumed, United Specialties Company will be prepared to manufacture its established truck-type accessories, as well as many new items now in the process of development. The same high standards of United quality and performance which are enabling us to Successfully handle the truck industry's vast requirements for vital war equipment today will be an integral part of our future products.

Our Sales Engineers will be found very cooperative and helpful in designing installations tailored to fit your particular specifications. Why not consult us when your plans are in the preliminary stage?

UNITED
GUARANTEED PRODUCTS

★ AIR CLEANERS ★ HOSE CLAMPS ★ IGNITION SWITCHES
★ METAL STAMPING ★ ROLLED SHAPES ★ DOVETAILS

UNITED SPECIALTIES COMPANY

UNITED AIR CLEANER DIVISION
CHICAGO, ILLINOIS

MITCHELL DIVISION
PHILADELPHIA

Diversification at Minneapolis-Moline

(*Continued from page* 24)

Cross hydraulic lathes, using cemented-carbide tools.

Next comes heat treatment in another special Johnston furnace in which the rough-machined shells are heated to 1700 F while rotated on spindles. Then the shell is hot-nosed in a 350-ton Baldwin-Southwark press. From this stage, the shells go to a battery of two large Mahr furnaces, first for hardening at 1600 F, followed by an oil quench, then through the Mahr normalizing furnace where the work is held at 100 F. It may be noted that the work is transported on a flight conveyor during this series of operations.

Work now moves on a long cooling conveyor, thence to Pangborn machines for shot blasting of the cavity, then Brinell hardness testing 100 per cent. The next stage is that of machining. First is the turning of the nose in Bullard Mult-Au-Matics. Both rough- and finish-turning are done with cemented-carbide tools of special steel cutting grade, principally supplied by Firth-Stirling. Then follow cutting-off of the center, weighing, turning to finish-weight.

The band seat, an intricately formed section, is machined in one operation, using a wide-faced Firthite tool. The thread is cut in Lees-Bradner hobbing machines, the O.D. ground in a Cincinnati Centerless grinder. A Kent-Owens hand mill is used for cutting a slot in the nose. The closed end then is sealed by welding a disc, using a Taylor-Winfield seam welder for the operation.

Finally the band is installed, then turned in a special machine built by M-M, holding the turning operation to a tolerance of 0.008 in. This is followed by inspection and washing and spraying of paint in a DeVilbiss machine. The shells are hung on a closed monorail conveyor to dry for about 45 minutes.

Production of the 20 mm shot is another outstanding operation, notable for its compactness and high productivity. The shell is formed from bar stock on a battery of 1⅞ in. Conomatics, completely in one setting. The work is cyanide hardened in a Johnston furnace, quenched, drawn in another Johnston furnace for 3 hours, then the O.D. is ground in a Cincinnati Centerless.

Prize exhibit here is the "shock" test for which the equipment was designed and built by M-M. This consists of a vertical installation of water baths through which the shot is moved in a regulated cycle on a special flight conveyor. In sequence, the shot is immersed in a cold water tank held at 40 F, then immediately into a tank of boiling water, then again into a cold tank at 40 F. This method quickly detects flaws in the metal, assures perfection of quality. For reasons of space economy the installation was specially designed as a vertical machine. It is

complete with provision for heating the boiling water tank, and a refrigerating system for cooling the 40 F tanks.

Following "shock" testing, the band is installed in a swaging machine, then turned to size. Final operations are—inspection, washing and spraying in a DeVilbiss machine fitted with a rotary table and automatic spray nozzles, packing.

Hopkins Agricultural Machinery Plant

Situated about 12 miles from the main plant is the Hopkins plant which combines the peace-time occupation of building agricultural machinery with the production of war goods of various kinds. Major war-time product is the fabrication of the welded chassis structure for mobile gun mounts. Welding operations are performed by certified welders, involves a battery of some 52 Lincoln Shielded-Arc welding machines.

The plant has its own forge shop, press and hammer shop, a cast iron foundry, and extensive sheet metal fabrication facilities spread over many acres of floor space. In addition, there is a large machine shop featuring many items of new equipment such as Cincinnati milling machines, K & T mills, Barnes Drill Hydram and Rockford vertical drilling machines. The sheet metal department boasts Bliss presses, Niagara machines, a versatile Verson narrow bed press used as a press brake and punch, a 250-ton Williams, White unit which is used as a press brake and punch, Thomson resistance welders, Cincinnati shears, etc.

The foundry is a modernized operation boasting many items of new equipment such as a Simpson Intensive Mixer for mulling core sand, large Despatch ovens for heat treating and baking, and a technique of core-blowing which has been adapted to the blowing of cores close to 60 inches in length. This is done with International machines, fitted with special heads developed by M-M engineers.

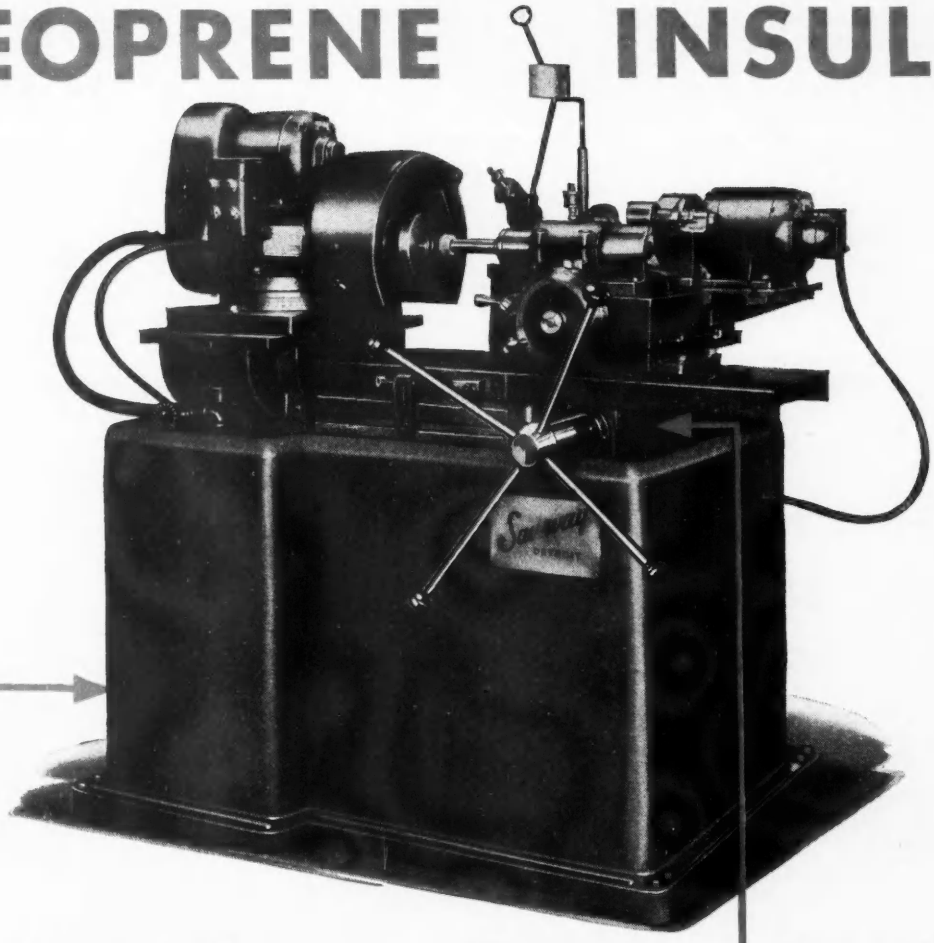
The foundry produces a wide variety of castings including large herringbone gears for the marine winches. One of the castings is quite unique. It consists of a bracket into which is cast a steel washer in such fashion as to permit the washer to turn freely. The washer is backed by material which burns out during casting, the washer being freed eventually by breaking the bond with the casting in a drill press set-up.

The management of this plant has done great things in the field of metal cleaning and painting by developing techniques of amazing versatility. Take as an example the "Flow-Coat" method developed here for the automatic painting of parts of every conceivable size and form, ranging from small single stampings to large and awkward fabricated assemblies. For this purpose they have built a long paint spray booth incorporating a series of automatic spray nozzles. These are so arranged as to reach all parts of the most complicated form of fabricated assemblies, even to the spraying of interior areas. Parts are hung on a monorail conveyor—the machine does the rest. For more conventional operations there is one of the large DeVilbiss spray booths, large enough to hold two complete agricultural machines at a time. After cleaning and painting the parts go through a 66 ft. baking oven.

Another large installation is a unit made by the International Conveyor & Washer Corp. for the cleaning of sheet metal prior to flow-coating or other painting operations. This is a spray nozzle type washing machine, using a hot alkali wash with two hot water rinses. The last stage of this big unit is a drier section.

Great strides have been made by the organization in the development of fabrication techniques for the manufacture of the gun mount chassis and other types of weldments. The welding department gallery has about 52 booths fitted with the familiar Lincoln welding machines. Each stage of welding is handled in massive steel fixtures to assure precise alignment of an assembly, the fixtures being mounted on motorized welding positioners of universal rotating type. On some operations such as the welding of a large ring to a sheet metal assembly or the preparation of circular welds, the positioner

NEOPRENE INSULATED



against Vibration, Distortion, Misalignment!

This radical departure from conventional design gives the Sav-Way multi-purpose internal grinder a new permanence of alignment and resulting higher accuracy. The bed proper is a thick surface-plate type normalized alloy iron casting of heavily ribbed whale-back construction. Neoprene pads between the bed and the steel base eliminate metal-to-metal contact and absorb floor vibration, preventing distortion of the base being transmitted to the bed, which is accurately scraped. This is only one of seventeen specific features which make the new Sav-Way M-1-A Grinder outstanding in design and construction.

For complete description and specifications, attach the coupon to your letterhead.

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SAV-WAY INDUSTRIES, 4875 E. 8-Mile Road
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Kindly send me a copy of the illustrated folder describing the Sav-Way M-1-A Internal Grinder.

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PRODUCERS OF SAV-WAY HAND AND HYDRAULIC INTERNAL GRINDERS · SAV-WAY GOLD SEAL SPINDLES · PLUG GAGES · PRECISION AIRCRAFT AND AUTOMOTIVE PARTS

is motorized for automatic rotation and is provided with an automatic feeding head for the welding wire.

The gun mount chassis is an exceedingly complex welded structure as may be appreciated from a visual examination of it. It is integrated from a large number of individual weldments, each of which is accurately jigged and held to close tolerances for final alignment. In the case of the top carriage section, comprising an assembly of forgings and sheet metal parts, they have designed a special straightening fixture for correction after welding. This fixture holds the work in alignment and permits corrective treatment by means of a large number of automotive type hydraulic jacks suitably mounted at critical locations.

All welded structures are heated for stress relief in a Despatch oven, large enough to accommodate the variety of parts produced here.

Much of the form cutting of sheet metal parts for the welded structures is done automatically to template on an Airco automatic torch cutting machine. A feature of this machine is the use of a magnetic tracer attachment which has worked out most successfully in this plant.

Among the latest developments in the welding department is the adoption of the Una Welding machine for the automatic welding of long seams, using a special type of flux. This arrangement should go far to increase the productivity of the department on jobs requiring long straight welds.

It may be noted in closing that the M-M plants encompass remarkable variety and diversification, far too comprehensive for anything but sketchy treatment in a study of this kind. We have covered a few of the outstanding high-spots in many corners of the plant without attempting to do full justice to the entire set-up. A selection of interesting factory views paralleling the operations mentioned in the body of the article should give our readers a better perspective of the gamut of activity.

More Data On Ring Springs

The Editor of
AUTOMOTIVE and AVIATION INDUSTRIES
Chilton Company
Dear Sir:

Referring to the article *Ring Springs Used in Plane Shock Struts* in your August 1 issue, I wish to comment as follows:

Your mention that the first German JU-88 bomber brought down more or less intact in England was equipped with a ring spring landing gear, and in this connection it may be of interest to note that the application of ring springs to landing gears originated in the United States, and that the first ring spring landing gear ever used in Germany was shipped from Pittsburgh in June, 1931.

As to the use of ring springs in German railroad buffers, it may interest you to know that all modern German railroad freight cars use ring spring buffers, while the old-fashioned volute springs are still used in the light type four-wheel freight cars. The ring spring draft gear, used on American freight cars, has made it possible to materially increase their protection against shocks in service.

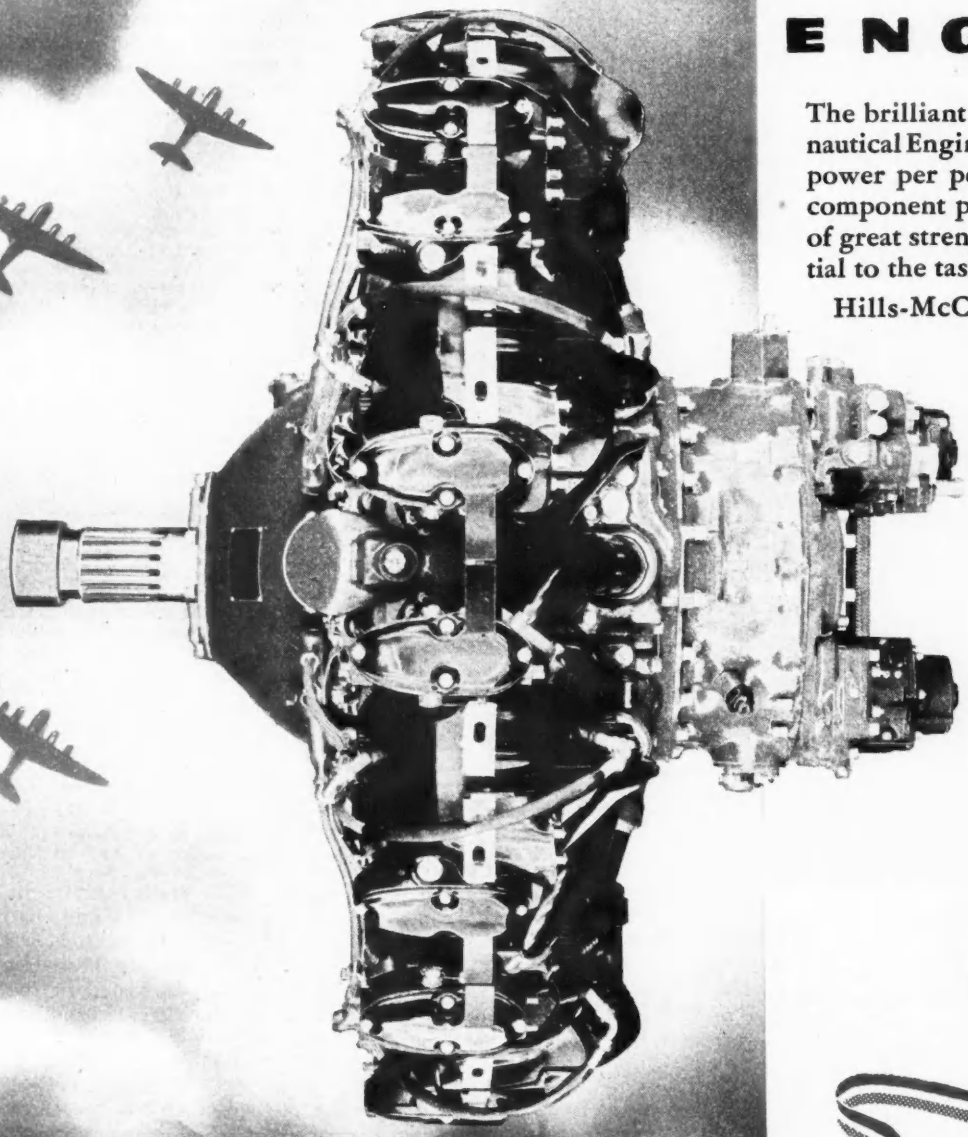
As to the work capacity of a ring spring, it is not about equivalent, but about four times greater than that of a helical spring of about the same weight. Compared with a lubricated laminated spring, the ring spring of the same weight will have up to about eight times greater work capacity.

The use of this new machine element is continuously expanding into new fields and the ring spring has been instrumental in solving many baffling problems in connection with vibrations and impacts.

Very truly yours,
O. R. WIKANDER,
Ring Spring Engineer,
Edgewater Steel Company,
Pittsburgh, Pa.

HILLS-McCANNA MAGNESIUM ALLOY SAND CASTINGS

PLAY AN IMPORTANT ROLE IN THE PRODUCTION OF *Wright* ENGINES



The brilliant Wright "Cyclone" Aeronautical Engine, designed for maximum power per pound of weight, requires component parts necessarily light, yet of great strength and endurance essential to the task.

Hills-McCanna Magnesium Alloy Sand Castings contribute this rare combination of qualities to the efficiency of Wright Engines through highly advantageous application

Our expert engineers, fortified with years of intensive experience with these castings can be of valuable assistance to you in your consideration of post-war plans and products

HILLS-McCANNA CO.
3015 N. WESTERN AVE. - CHICAGO

PROPORTIONING PUMPS - AIR & WATER VALVES - CHEMICAL VALVES
MARINE VALVES - FORCE-FEED LUBRICATORS - BOWMETAL CASTINGS

National Metal Congress

(*Continued from page* 43)

investigated. On the basis of 10 million stress reversals the endurance limit for the furnace copper brazed assemblies gave (a) 17000 to 18000 psi for the untreated joints and (b) 25000 to 27000 psi for the joints quenched and tempered after brazing. Silver brazed assemblies made with an oxy-acetylene torch and no heat treatment after brazing gave an endurance limit of 18000 psi. Pieces of 2-in. diameter solid bar stock of SAE 4300 steel were butted together under pressure and welded by means of an annular arrangement of oxy-acetylene flame tips surrounding the joint. Upset joints formed in this manner were heat treated to about 293 Brinell and then machined so that the plane of the joint was in the center of the test section. These members were then tested in fatigue in rotating bending as a cantilever beam with the plane of the weld located in region of maximum bending stress. An endurance limit of 55000 psi was established which is believed to be only about 10 to 15 per cent less than for the same specimen without the weld.

Bright Gas Quenching of SAE X-4130 and NE 8630 Welded Aircraft Tubes

by Wm. Lehrer, Surface Combustion Co.

THE physical properties stipulated by the AN-T-3 specifications for normalized SAE X-4130 welded aircraft tubing are secured in large production furnaces by bright gas quenching in a superfast cooling zone which is located immediately adjacent to the heating zone. The paper gives a brief description of the evolution of the gas quenching zone and of its construction and discusses in detail the results obtained with it. The results produced by gas quenching SAE X-4130 steel are applicable to NE 8630 steel as shown by the accompanying table. Although a somewhat higher average yield and tensile strengths resulted for the X-4130 steel, which can be attributed to its higher carbon content and greater gas circulation rate in the quenching zone, taking these two factors into consideration it must be concluded that for all practical purposes the NE 8630 steel is capable of developing that same physical properties upon gas quenching as the SAE X-4130 steel and that the heat treatment involved in gas quenching and in aging is identical for both types of steel.

A Paper on Spot Weld Joint Efficiency for Aluminum Alloys

by C. W. Steward, Research Laboratory, Curtis Wright Corp.

ONE of the design problems about which little has been published is that of the maximum efficiency of a multi-spot joint used for splicing sheets of aluminum alloy together. This paper is presented for the purpose of reporting the major results of fairly thorough study of the factors which contribute to both high and low joint efficiency and to production economy. The following are the conclusions reached as a result of this study:

1. Maximum joint efficiency obtained was 100 per cent, as indicated by several samples which failed outside the weld pattern. However, the average was 93 per cent.
2. Maximum stress developed on a standard specimen was 61,800 psi. The average was 59,800 psi.
3. The ideal spot pattern for 24S-T Alclad in .040 thickness is one in which the spots are spaced ½ in. apart in both directions. Reduction in this spot spacing is likely to result in a loss in strength of the joint.
4. Maximum efficiency is attained with AC welds.
5. High strength spots are better than low strength spots for maximum efficiency and production economy.
6. Wire brushing is better than chemical cleaning.
7. The presence of small cracks, visible by X-ray only, is not critical.
8. Higher strength welds (free from small internal cracks) can be made with AC equipment than can be made with DC equipment.
9. For stored energy machine, current wave shape makes very little difference in joint efficiency.

The Strength of Heat Treated Steel Bolts

by G. Sachs, P. S. Cole and R. A. Roth, Case School of Applied Science

SAE 2330 steel exhibits its highest tensile strength and hardness if tempered at 200 to 400 F after oil quenching. This applies also to bolts in this alloy, if tested in the regular manner. However, if bending is super-

Comparison of Physical Properties of S.A.E. X-4130 and NE 8630 Welded Tubes

Tube No.	S.A.E. X-4130 Yield Strength P.S.I.	S.A.E. X-4130 Tensile Strength P.S.I.	S.A.E. X-4130 Elongation Per Cent	NE 8630 Yield Strength P.S.I.	NE 8630 Tensile Strength P.S.I.	NE 8630 Elongation Per Cent
1	96,400	144,000	15.0	96,400	138,400	14.0
2	98,700	149,200	15 0	87,300	137,200	15.0
3	85,000	149,600	15.0	90,500	135,200	16.5
4	90,900	142,500	16.0	86,500	136,400	15.0
5	86,500	141,000	16.0	87,500	137,600	13.0
Average	91,500	145,000	15.40	89,650	137,000	14.70

imposed to tension, the strength of high strength bolts will be considerably reduced, the maximum strength being 160,000 psi, after tempering at 1000 F. Higher strength bolts break underneath the head in a brittle fashion, rather than in the generally weaker threaded part. This embrittlement and loss in strength can be eliminated by providing a fillet under the head of the bolt.

Quality Control in Aircraft Spotwelding

by Nathan C. Clark, Lockheed Aircraft Corp.

THIS paper is a review of the steps that may be taken to insure the highest quality of spotweld production in the aircraft industry. Several terms are defined in order to preclude ambiguity in the body of the article. It is shown that of the various procedures considered, the practical solution to the problem of quality control of spotwelding production involves three basic requirements. These are (1) standardization of the equipment and process, (2) the application of statistical control, and (3) monitoring of the spotwelding machines or non-destructive testing of the finished product.

Effect of Time, Temperature and Prior Structure on the Hardenability of Several Alloy Steels

by J. Welchner, E. S. Rowland and J. E. Ubben, The Timken Roller Bearing Co.

FIVE common alloy steels, SAE 4620, NE 9442, SAE 4140, 3240 and 4340 were used in this investigation. The effect of five prior structures, namely, spheroidized, annealed, normalized, hot-rolled, and quenched, on Jominy hardenability over time intervals of 0, 10, 40 minutes and 4 hours at 1525 F were explored. The effect of a range of quenching temperatures from 1450 to 1600 F was determined on the annealed and normalized prior structures. End quench curves for the variety of conditions are presented together with summarizing curves to show the effect of the several factors at Rockwell C 50 (Rockwell C 37 for the SAE 4620 type) level of comparison.

A Study of the Nitriding Process I. Effect of Ammonia Dissociation on Case Depth and Structure

by Carl F. Floe, The Nitralloy Corp.

DEPTH-HARDNESS characteristics and microstructures were determined for nitride cases produced at dissociations of ammonia varying from 15 per cent to 85 per cent. Results are shown for different time intervals of nitriding nitralloy 135 steel from 5 hours to 100 hours. It was found that for all dissociations up to at least 65 per cent, a white layer, consisting largely of Fe_2N, was formed very shortly after nitriding starts. The depth of this white layer decreases with increasing dissociation

of ammonia. The total depth of case beneath the white layer for a given time of nitriding was found to be practically the same regardless of the dissociation up to 65 per cent. At 85 per cent dissociation very little white layer is produced and the depth of case for a given time of nitriding is inferior. A considerable saving in ammonia may be effected by nitriding at high dissociations.

Spotweldability of Low Carbon Steels

by Leon C. Bibber and Julius Heuschkel, Carnegie-Illinois Steel Corp.

THE paper gives the results of some 4000 spotwelding tests on 15 different grades of steel of 6 compositions. It describes the newly developed low carbon USS Air-Ten steels varying in yield strength from 25,000 to 100,000 psi, and shows the effect of this large variation on their spotweldability. Corresponding data are given for 4 different tempers of USS-18-8 stainless steels. A few results are also included of the spotwelding tests on 4608, 4017, modified 8620 and X4130 steels. All welds were made with a single impulse. Specific and complete information on tension-shear tests, tension-pullout tests, twist tests, impact tests at plus 75 F. and —68 F. are given, as well as the results of special tests to determine the effect of spotwelding on the strength of continuous cold-reduced materials.

Weld-Bead Hardness Tests on Some Carbon, Nickel, and Nickel-Chromium War Department Steels

by Oscar E. Harder and C. B. Voldrich, Battelle Memorial Institute

WELD-BEAD hardness tests were made on 34 War Department steels. These steels included 22 plain carbon steels, 3 nickel steels, and 9 chromium-nickel steels. All of the steels were tested at original plate temperatures of 65 F.; those steels which developed hardnesses in excess of 350 Vickers or showed cracks were welded at plate temperatures of 300 F., while steels which developed maximum hardness below 350 were welded at –20 F. The paper gives details for the composition of the steels, forging and normalizing practice, and welding and testing procedures.

Electronic Control of Gas-Cutting Machines

by R. D. McComb, Industrial Control Division, General Electric Co.

THIS paper presents in non-electronic language an explanation of how the new photoelectric template control operates to control the movement of a gas-cutting machine. This is followed by an explanation of the electronic circuit. The operation of the control is described as the machine follows a straight line, a curved line, and sharp corners. A discussion of the order of magnitude of possible errors which may occur is given, and the improvements which this machine may produce in quality, quantity, and costs are discussed.

Machine Cutting for Assembly Line Fabrication

by C. O. Adams, Delco Products Division of General Motors

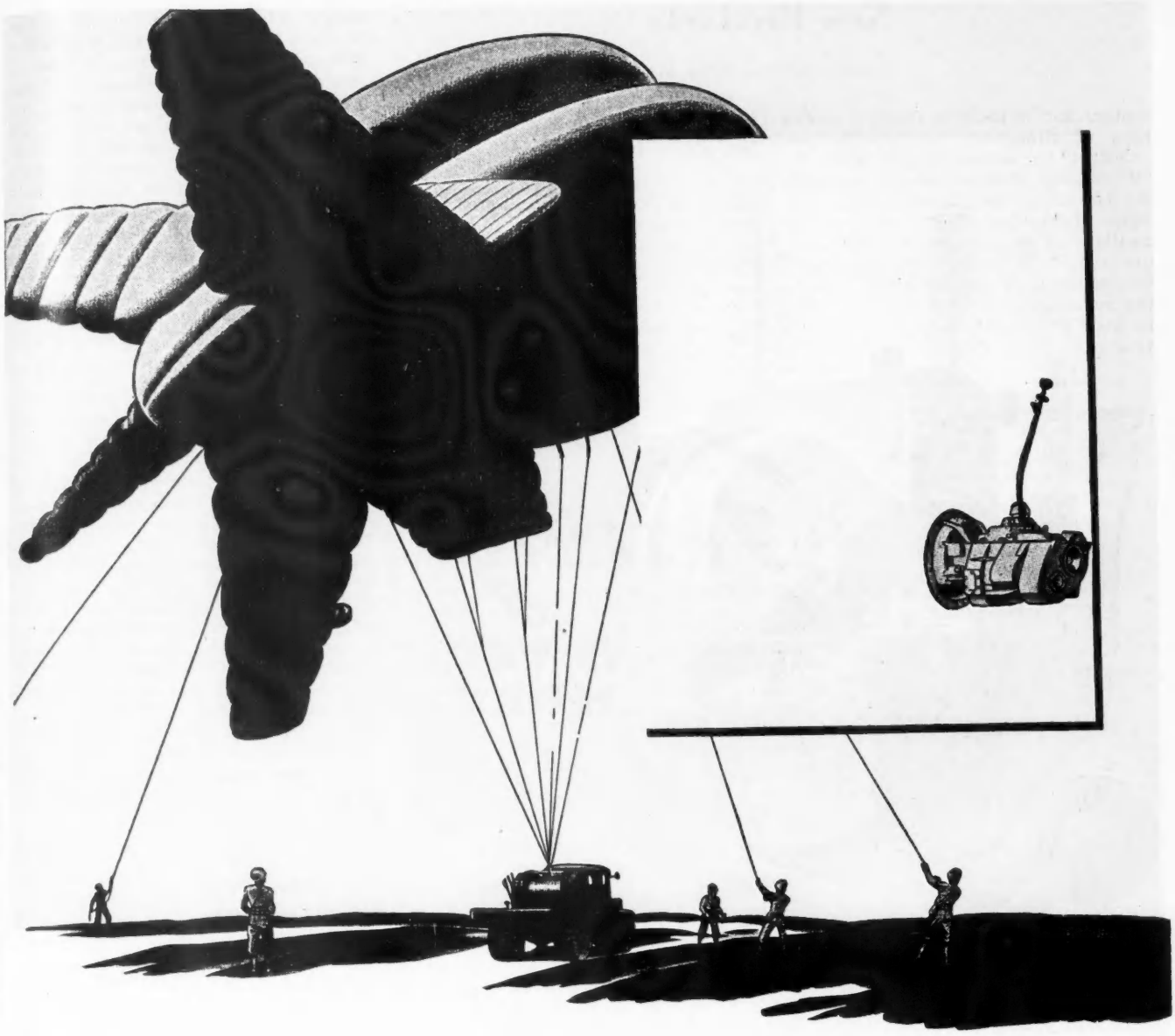
THE purpose of this paper is to present some applications of machine cutting to assembly line fabrication of generator parts for diesel electric units required in the war effort. It first covers the requirements of cutting machines for assembly line operation and the general methods of operation and layout. Then follows a discussion of some tooling, processing, and production problems involved in the shape cutting, edge preparation, and scheduling of flame cut parts, and their relationship to fabrication within the assembly line.

Why the Weld Recorder

by J. Van den Beemt and J. R. Fetcher, E. G. Budd Mfg. Co.

THE heat generated in the zone of a resistance weld is equal to I^2RT. The principal variables of a resistance welding set-up are weldability, electrode size and shape, electrode force, current, and time. This paper describes the theoretical and practical application of the Ampere-Squared-Second-Re-

(*Turn to page* 158, *Please*)



Spicer Transmissions...

meeting America's emergencies on the ground and in the air

Barrage balloons present a formidable barrier to dive bombers, and are playing an important role in defense of war industries and military areas. Hundreds of these great balloons are manipulated with winches using Spicer Transmissions . . . the same dependable power delivery units which so long have served American oil fields, logging industry, automotive manufacturers, and other industries. Spicer was ready when war came . . . Spicer again will be ready for peacetime production on V-Day. Spicer Corporation, Toledo, O.

40 YEARS OF Spicer SERVICE

BROWN-LIPE CLUTCHES AND TRANSMISSIONS • SALISBURY FRONT AND REAR AXLES

SPICER UNIVERSAL JOINTS • PARISH FRAMES, STAMPINGS

New Products

(*Continued from page* 44)

centers and is built to conform to Bureau of Standards recommendations.

MF-240-N is constructed with the "V" wiring channel which separates the two lamps and thereby eliminates light absorption from one lamp to another. The non-metallic reflectors are removable from the top without interrupting lamp operation. When the reflectors are removed, all wiring in the "V" channel is exposed to full view.

Pebble Finish for Machine Surfaces

The Sherwin-Williams Company, Cleveland, Ohio, has recently developed a new "pebble" finish for machine tool surfaces which not only uses less finishing materials but can be applied in less time. Called a "pebble" finish because of its physical appearance, this new method of protecting machine tool surfaces is said to provide a successful solution to the problem of how to dress up a machine surface without fillers, sanding and numerous coats of sealing paint. WPB officials, in an effort to boost tool output, has prohibited the use of fillers, sealers and similar finishing materials, and has also restricted the number of coats of paint that could be applied. With the new method, however, it is now possible to finish a machine tool in three operations instead of seven as formerly required.

Packaging Parts for Overseas

One of the problems of Government contractors has been the satisfactory packaging of machine parts for overseas transport.

It has been a problem of protecting the parts against salt water, corrosion, climatic and atmospheric changes. Papers have had to stand rough handling and yet permit speed and ease of wrapping.

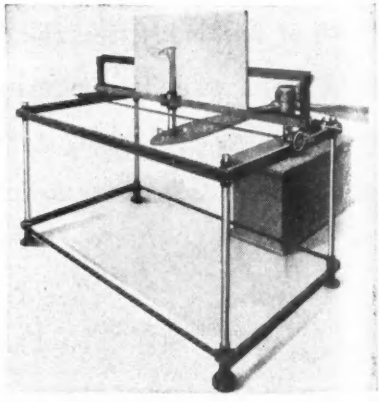
A paper that is said to have proven exceptionally useful and that meets all Government specifications for greaseproof and non-corrosive papers is KD8-C-17, distributed by Criterion Paper & Twine Co. of New York, N. Y.

This paper is not only greaseproof and non-corrosive but it can be heat sealed into bags. It is approved by Forest Laboratories, Government testing agency.

For Duplicating Exact Contours

A device which makes it possible to ascertain the exact contour of irregular surfaces in a fraction of the time required by the former laborious method of cutting and fitting wood templates has recently been placed on the market by Inter-Lakes Engineering Company, Detroit, Mich. The instrument, which is called the "Dupligraph", transfers on transparent paper the exact contour of the irregular object, such as the propeller blade here illustrated. It will also transcribe the contour directly on metal.

The use of the Dupligraph is said



The Dupligraph

to be particularly advantageous for securing concave readings in forming dies which frequently cannot be checked with ordinary templates. It also solves the problem of securing a true reading of a stamping, showing the amount of spring-back and warp.

In the manufacture of products which require the close following of models, the Dupligraph gives cross-section lines relative to each other. This is usually done on vellum and checked against the draft or layout.

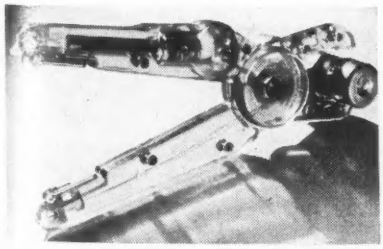
Stellite Alloy for Small Mechanisms

An alloy of tungsten, chromium, and cobalt is now being delivered by Haynes Stellite Company, New York, N. Y., in a form adaptable to instrument bearing pivots, needle valves, and similar applications. This stainless metal is resistant to many corrosive media and all normal atmospheric conditions. As it is not possible to machine it in small parts, these are cast close to size and approximate shape and finished by grinding, and lapping if necessary.

The properties of this Stellite alloy, according to the manufacturer, include a tensile strength of approximately 65,000 lb per sq in., a hardness of Rockwell C-60 to C-62, high resistance to wear, an unusually low coefficient of friction, the ability to take a high polish, and excellent resistance to corrosion, whether from atmospheric conditions or chemical agents, such as water solutions of various salts, alkalies, and acids. Easily fabricated and virtually non-magnetic, the alloy can readily be brazed or welded to steel or other base metals, for use in instruments or mechanisms where non-magnetic, or corrosion- and wear-resistant parts are essential.

At the present time, the alloy is being furnished in many cast forms, such as pins for pivots and shafts, which are centerless-ground to specified diameters.

Fuse Puller



This fuse puller is made of Lumarith cellulose acetate, which was selected by the manufacturer after considerable experiment to determine the most suitable material. A small bulb, enclosed in the handle, tests fuses or base receptacles. These fuse pullers are being supplied by the Star Fuse Company, Inc., New York, N. Y.

New Production Equipment

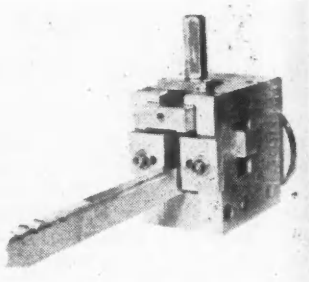
(*Continued from page* 41)

vided with sight gages. The saddle ways are lubricated by automatic gravity feed. All ways are hardened and ground. Coolant supply lines and electrical control conduits come through the rear of the machine base to a convenient manifold arrangement below the saddle. The doors of the electrical panel cabinet are interlocked with the main circuit so that they can be opened only when the main current is off.

In the illustration the operator is in position to start the cycle and is within easy reach of push buttons which control the complete operation of the machine. At this same control station is a master stop, saddle feed selector, coolant control and headstock control, forward, reverse and stop. A bank of lights tells the operator whether or not the saddle is in feed and the direction of movement.

THE American Broach & Machine Company, Ann Arbor, Mich., is introducing a new type American Keyway Broach Pull Head No. 1. Although developed primarily for pulling keyway broaches of virtually all sizes, this puller can also be utilized to pull rectangular and oval broaches or broaches of any other shape. The pull head can be manually or automatically operated, depending upon the work part and whether or not the broach must be disconnected between cuts. When automatic operation is desired, it is only necessary to attach a threaded stud to the sliding member of the head.

Since this head can be used with almost any size keyway broach, the need for various size threaded pullers is eliminated. Also, in using this head the cross section of the keyway broach shanks can be considerably larger and therefore stronger than the threaded type shank. The head holds the broach in rigid alignment against flat surfaces and is equipped with adjustable centering gates assuring elimination of side-



American Keyway Broach Pull Head No. 1

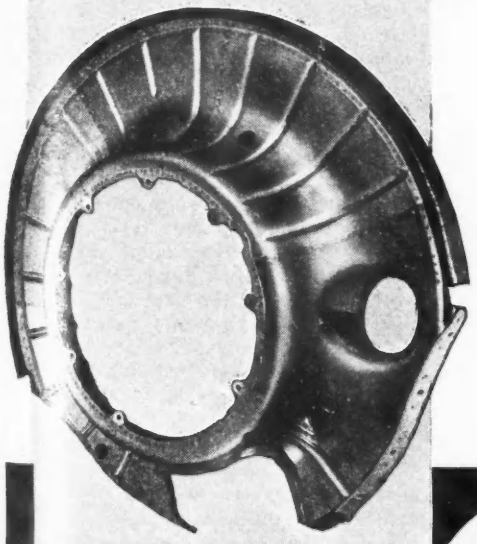
ward movement of the broach. A positive pulling lock is provided through a cam arrangement holding the locking key in the cross slot of the broach shank.

Each of these broach heads is furnished, with a set of adaptors for attachment to threaded keyway broaches as well as two extra cams for adjusting head for various size shanks, centering gates on front of head and four riser plates which can be placed in the head below the broach in making suitable adjustments for various types of shanks. The head, as furnished, is suitable for automatic or manual operation.

THE Ragan Radiant Heater and Resistor is now in production at Techtmann Industries, Milwaukee, Wis. Designed for use in annealing ovens, electric furnaces, or wherever high temperature radiant heat is required, the heater also serves as a resistor. The element consists of a helical coil of nickel chromium wire bound spirally around the refractory core. The binding posts and straps are of monel metal or nickel chrome, depending upon the users' specifications. Obtainable in a range from 32 volts to 220 volts.

Guiberson

PRECISION BUILT AIRCRAFT PRODUCTS



Fire-walls, flap track supports, seats, motor mounts, sumps, cowling, manifolds, scoops, heating systems, tanks, collector rings and a multitude of sheet metal and drop hammer parts of all kinds backed by 22 years of experience in precision manufacture.

ANOTHER STAR *that* WILL NOT TURN TO GOLD!

A tracer bullet, a broken gas line and searing flame leaps back toward the cockpit. But there it stops . . . held at bay and confined by the fire-wall while precious minutes are won. Minutes that often mean a safe landing and another pilot saved . . . minutes that mean another star in the window of an American home that will not turn to gold. The saving of a single American pilot far more than justifies the extra care and precision that goes into the building of every Guiberson fire-wall and every other Guiberson built aircraft part.

SAFE THAN SORRY BETTER BE GUIBERSON

ESTABLISHED 1919

AMERICA'S ONLY RADIAL AIR-COOLED DIESEL ENGINE BUILT BY GUIBERSON

Guiberson U.S.A.

THE GUIBERSON CORPORATION
GUIBERSON DIESEL ENGINE COMPANY
DALLAS, TEXAS

Committee Tackles Detroit Job Problem

(*Continued from page* 46)

ins, Detroit Regional WPB Director, is chairman of the committee which includes representatives of the WMC, Navy, Detroit Ordnance District, Army and Navy air forces and the Maritime Commission.

The UAW-CIO at its ninth annual convention in Buffalo reaffirmed its no-strike pledge but in cases where it believes that management is not acting in good faith and taking advantage of the war, it empowered the international executive board to demand government operation of such plants under the Smith-Connally Act. However, despite renewal of the pledge, six unauthorized strikes involving locals of the UAW-CIO occurred in Michigan plants the week after the convention. Four thousand employes of the Kelsey-Hayes Wheel Co. machine gun plant at Plymouth, Mich., were idle for 2½ days when they walked out after two workers were fired for fighting with foremen.

Production of B-24 bombers at the Ford Willow Run bomber plant was threatened by a five-day strike of 700 women at the Essex Wire Co., Detroit, which manufactures aircraft wiring installations. The women struck over wage rates but the company has been plagued by several strikes in recent months due to a jurisdictional dispute between an independent union, which holds a bargaining contract with the company, and the UAW-CIO. Essex workers had voted to strike, 992 to 306, in a poll under the Smith-Connally Act, Sept. 11. Other brief strikes involved 250 employes of Continental Motors Corp., Detroit, over wage classifications, 700 workers at the Adrian plant of Bohn Aluminum & Brass Corp. over failure to negotiate a contract, 2600 employes of Aluminum Co. of America at Detroit after five shop stewards were suspended and 500 workers at the Ford Rouge magnesium smelter over job classifications.

The UAW-CIO convention also took a strong stand against incentive pay plans, reiterating its opposition to introduction of such plans in plants where they do not exist. The international union left to the autonomy of local unions the continuance of piecework systems already in effect but it took a firm stand against extension of incentive plans. The resolution submitted by the majority of the resolutions committee and adopted after a 5-hr debate stated, "Piece-work will result only in further aggravating the dislocation and unbalancing of production schedules, resulting in layoffs, unemployment and dissipation of our manpower. Piece-work systems would have the result of further intensifying the problem of wage inequalities and differentials, will block the union's efforts to establish an industry-wide wage agreement based upon equal pay for equal work, and will further demoralize workers who are, at present, getting less money for doing the same work. Piece-work systems would reintroduce the old system of speed-up, in which the worker is robbed of higher earnings through management's using every insignificant engineering change or pretext to cut rates.

"Assurances given labor that piecework will not mean destruction of their standards have been belied by decisions of the WLB in Detroit which refused to restore wage cuts which had been inflicted on Timken-Detroit Axle piecerate workers through the arbitrary action of the management; and we refer also to the decision of the National WLB of Oct. 2, 1943, which held that if the workers in the Grumman Aircraft plant increase production by 10 per cent they may be granted wage increases of no higher than 5 per cent."

In the Timken-Detroit Axle contract case, which the union has appealed to the National WLB, the UAW-CIO wanted a guarantee that no employee on piece-work would receive less than his previous minimum earnings regardless of his output.

By This Simple, Cold Immersion Method

Because cleaning of aircraft pistons is considered a process apart from other aircraft overhaul operations, TURCO CARBRAX was formulated to fill this very special need. Its use presents the fastest, as well as the most thorough piston cleaning method yet devised.

TURCO CARBRAX simplifies the decarbonizing of pistons because it involves no more than simple cold immersion in a tank.

Its penetrating action attacks deposits of hard carbon, engine "varnishes," chlorides, bromides and sulphates formed by combustion of high test "leaded" aviation fuels. TURCO CARBRAX is harmless to aluminum and other reactive metals.

SEND FOR THE TURCO BOOKLET ON AIRCRAFT ENGINE OVERHAUL PROCEDURE WITH TURCO CARBRAX. IT IS SAFE, ECONOMICAL AND FAST.

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ON YOUR LETTERHEAD, PLEASE

47-113

Notes on Light Motor Cars

(*Continued from page 30*)

European cars is always close to 1.0.

(3) It is highly desirable that a greater proportion of the total occupied volume of the vehicle should be usable as passenger space. To save weight on the average American automobile is a rather obvious operation requiring no drastic change of shape or arrangement. The obvious first step is to leave off the things which add space and weight while contributing nothing to the effectiveness of the vehicle.

(4) It is often stated that there is absolute virtue in weight in a vehicle. In support of this it is argued that almost any vehicle rides better as the load is increased. The argument does not hold water; the ride of the vehicle has been improved because the increasing load has increased the static spring deflection, and in certain cases, as for example the addition of luggage in a passenger car, has also increased the moment of inertia of the sprung mass. One virtue of the larger vehicle is that, since it is a less efficient passenger carrying instrument, its passenger load is a less proportion of the total weight, so that the variation in ride with varying passenger loads is less than in the case of the light cars.

(5) The saving of weight demands a correct and careful study of the possibilities of so-called "frameless construction." It should be noted that all closed passenger car construction is frameless to the extent that the ordinary closed car body contributes to the overall stiffness of the vehicle in greater proportion than the stiffest frame; that completely frameless construction, whereby the wheels and running gear are fastened directly to the body, has been less in evidence in more recent passenger car designs, although it is gaining ground on bus construction.

(6) There is apparently no chance for improving the passenger vehicle by changing the location of the power plant. This belongs in front on a passenger car just as definitely as it belongs at the rear in a bus. No considerable improvement in weight, cost, convenience or the efficient use of space and material is to be expected by a drastic relocation of the power plant.

Allegheny Corporation Acquires G.A.C. Stock

All the Common stock of General Aircraft Corp., Astoria, L. I., has been acquired by the Allegheny Corp., which holds stock in a number of industries. General Aircraft is making large gliders for the Army. It was formed in October, 1939, and undertook an order for Army gliders in November, 1941. The first of these was delivered in September, 1942.

HOW WILL *your* EQUIPMENT MEET THE CHALLENGE OF A POST-WAR WORLD?

WHAT kind of a car will satisfy a bomber pilot? Will a jeep driver take four-wheel drive for granted on the truck he handles after the war? The buses of tomorrow—what will they be like?

Right now, one guess is as good as another. But certainly, this new equipment, that millions of eager buyers are already dreaming about, will be light in weight—much lighter than is the rule today. And it will have to be strong, too, to stand up under the faster speeds that seem certain for the future.

That is why we remind you now of the weight-saving possibilities of construction with U·S·S COR-TEN. Used wherever strength is essential and where welding problems enter into the design, COR-TEN will *safely* reduce weight for three good reasons.

COR-TEN is very strong—its yield point of 50,000 lbs. per sq. in. min. is 1½ times that of structural steel. Because its endurance limit is more than three times that of non-ferrous "light" metal, COR-TEN has an amazing capacity to absorb vibratory and twisting stresses that rack the life out of bodies and frames. In addition, COR-TEN has high corrosion resistance—4 to 6 times greater resistance to atmospheric corrosion than plain steel.

No COR-TEN is available right now for car, bus or truck construction. What is being produced is going directly into war equipment. But COR-TEN will be back when the fighting is over. So get the facts about this superior steel and plan to use it where it will do the most good. Our engineers will be glad to give you whatever information you need.

USS

UNITED STATES STEEL

U·S·S High Tensile Steels

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Supply Company, Chicago, *Warehouse Distributors*
United States Steel Export Company, New York

Salt Bath Treatment

(*Continued from page* 40)

bath line, serious corrosion of the electrodes and subsequent arcing at the contacts will result. At least one of the companies manufacturing this type of furnace is now supplying electrodes welded to the holder. Hand equipment for changing electrode assemblies are also furnished at a nominal cost. This latter arrangement makes it possible for one man to change the electrodes.

When gas heated or external electric heated pots are used, the pot must be an alloy of chromium and iron. Metals containing high nickel are not satisfactory for holding barium chloride, which is the base of all neutral salts. Barium chloride will attack the nickel and corrode the pot out in a very short time. Longer life will be obtained on the chrome-iron pots if they are first used as a cyanide or liquid carburizing pot for 30 to 100 hours.

Contrary to the opening paragraph of this article, many aircraft accessory parts such as instruments, hydraulic and lever mechanisms, etc., which are not highly stressed, are case hardened. These are small parts and are best treated by liquid carburizing. This process is adopted generally where parts are small and case depths are light (.025 in. or less). The problem of uniformity of case and cleanliness of the part after treating is readily overcome by liquid carburizing. This process is carried on in the same furnaces that are used for the neutral salt bath process except that an activated cyanide salt is used. The cases are always fine grained and have high physical properties if correct temperatures are used. Warpage is generally less than that obtained from gas carburizers.

Operating times and temperatures are difficult to predict without knowing the size and shape of the part, and the conditions it must meet in service. However, in general it is better to use lower temperatures and longer heating cycles in a neutral salt bath. Material treated in a salt bath should be heated at about 25-50 F. lower than it would be heated in a radiant or atmosphere furnace. Heating in the salt bath is faster due to direct heat contact, but longer soaking periods are possible as explained before. The cycle required in a salt bath is approximately one-half of that required in a radiant furnace. However, the lower temperature and longer soaking period has been found to be very useful when using a salt bath as the heating medium. The accompanying table gives a few steels and their recommended hardening temperatures and heating periods.

Keep in mind that salt baths are not foolproof and they will not solve all your heating problems, but given the proper care and operation they are the best general means for the heat treatment of relatively small aircraft parts as well as the larger sheets, sections, forgings and structures made of aluminum alloys.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 193[illegible]

Of AUTOMOTIVE and AVIATION INDUSTRIES, published semi-monthly at Philadelphia 39, Pa., for October 1, 1943.

State of Pennsylvania } ss.
County of Philadelphia }

Before me, a notary public in and for the State and county aforesaid, personally appeared Joseph S. Hildreth, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the AUTOMOTIVE and AVIATION INDUSTRIES, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Chilton Company, Chestnut and 56th Sts., Phila. 39, Pa.; Editor, Julian Chase, 5601 Chestnut St., Phila. 39, Pa.; Managing Editor, None; Business Manager, Jos. S. Hildreth, York Lynne Manor Apts., City Line & Berwick Rd., Overbrook, Phila. 31, Pa.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Chilton Company, Chestnut and 56th Sts., Phila. 39, Pa.

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is (This information is required from daily publications only.)

JOS. S. HILDRETH, *Pres. & Business Manager.*

Sworn to and subscribed before me this 23rd day of September, 1943.

BESSIE F. HAMMOND

(My commission expires January 7, 1945.)

[SEAL.]

for THIS battle, G.H.Q. is at YOUR own desk!

★ Here's how you—yes, YOU—can carry out a smashing "pincer movement" against the Axis. Swing in on one flank with increased production of war goods! Drive in on the other with redoubled purchases of War Bonds through your Pay-Roll Savings Plan!

You're an officer in both of these drives. Your personal leadership is equally vital to both. But have you followed the progress of your Pay-Roll Savings Plan as closely as you have your production?

Do you know about the new Treasury Department quotas for the current Pay-Roll Allotment Drive? *Quotas running about 50% above the former figures?* You see, these new quotas are based on the fact that the armed forces need more money than ever to win the war, while the average worker has more money than ever before to spend. Particularly so, on a *family income* basis—since in so many families several members are working, now.

Remember, the bond charts of today are the sales curves of tomorrow! Not only will these War Bonds implement our victory—they'll guard against inflation, and they'll furnish billions of dollars of purchasing power to help American business re-establish itself in the markets of peace.

So get this new family income plan working at once. Your local War Finance Committee will give you all the details of the new plan. Act today!

This advertisement prepared under the auspices of the War Advertising Council and the U. S. Treasury Department.

LET'S KEEP ON Backing the Attack!

Weld Recorder

(*Continued from page* 82)

corder in checking I²T, the "invisible" variables, Current and Time. The other three variables which determine the risistance, R, can be controlled by visual shop supervision. The recorder can be used only with synchronously controlled welding timers and is considered as an accessory to good line regulation, voltage compensation, sequence timing, and other devices for providing uniform welding control. The purpose of the recorder is to compare the electrical conditions under which a test weld is made on the job. When used intelligently, it is of great assistance to the Production Department, Welding Supervision, Welding Maintenance, and Sales Department.

Bellanca Again Making Complete Airplanes

Bellanca Aircraft Corp. has resumed manufacture of complete airplanes at its plant in Newcastle, Del., after a two-year lapse. It is producing the Ranger army gunner trainer, a two-engine, five-passenger training plane. Bellanca ceased commercial delivery of planes in September, 1941, after reducing such production in 1939 to concentrate on making parts for Martin bombers.